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ROLE OF ENGINEERS IN INDIA*

IT is an extraordinary fact and unfortunate fact that the enormous resources available in India have not been utilised for raising the standard of the nation. It is clear that with the proper utilisation of the present resources of India we can raise the standard very greatly.

Nevertheless, the fact remains that not only do we not utilise them to the best advantage but we actually waste the existing resources in destructive activities. That is a tragedy of the present generation.

* Extracts from an Address delivered by Pandit Jawaharlal Nehru on 6th December 1948 while inaugurating the 19th Annual Meeting of the Central Board of Irrigation.

Even more so it has been of the past generation. Somehow, we always find in history in the past age and in the present age that there are conflicting forces, forces of construction and forces of destruction. We find this conflict in the attitude of nations towards one another and among groups and ultimately perhaps in the spirit of man himself.

No man can work effectively without faith in himself that the forces of construction are there. Look at the map of Asia and of India. It stares at me in my room in the office. Whenever I look at it many pictures come up before my mind's eye, pictures of the long past history, of the

actual development of man from the earlier stages, of the beginning of culture and civilisation and of agriculture of the early days. Then my attention is concentrated on that huge block of mountains—the Himalayas. Look at them! Can you think of any other part of the world with such a magnificent stretch of mountains with such a vast reservoir of power and potential strength locked up in them! I know of none. How can we utilise it? There are many ways but essentially it is the job of the engineers to tap this vast power. River valley schemes, more or less, scratch the surface and it may be that many generations may pass before we have gone very far in exploiting this tremendous power we have got. In all these, engineers can play a very effective part.

Our task requires the co-operation of a large number of persons. From the top to bottom, if that co-operation is lacking and the spirit of working together is lacking, that job cannot be done properly and is delayed.

We have a very big job to do in this country in every sphere. It is no good complaining of uncomfortable things

happening around us. Since we are born in this period, we have to face them and conquer our difficulties. There is going to be little rest or real peace for us. There are going to be no dividends. The prospect before us is work, hard work. You must divert this hard work into constructive channels.

I do wish the engineers present here to realise that the responsibility of the constructive effort is tremendous and a great deal depends on how they discharge that responsibility and in what spirit they discharge it. I want you to infuse in your work the higher spirit of doing a fine job in fulfilment of certain objectives and ideas. You see ancient structures, mosques, temples. No one knows who built them but anyone can see with his eyes that people who built them were not only fine engineers but men of faith in their work. No one can build such things unless he has faith. We are living in a different age. We do not spend our time in making mosques and temples, but we build many types of public works. I would like you to work with that faith and you will find that if you work in that spirit the results will be great.

WORLD SCIENTISTS DISCUSS ATOMIC CHEMISTRY

DISTINGUISHED world scientists will gather in Britain towards the end of March for a week's conference and interchange of ideas on atomic energy chemical developments.

The gathering, to be held during the week beginning March 28, has been arranged by the Atomic Energy Research Establishment of the British Ministry of Supply in conjunction with the Chemical Society.

The first part of the conference, to be held in Oxford from March 28 to 30, will include a

discussion on the chemistry of the Heavy Elements and on methods of separating radio isotopes.

The latter part will take place in London, and papers will be given on the use of radioactive tracer elements in chemistry, and will include applications in physical, inorganic, organic and bio-chemistry.

The conference will be attended by Fellows of the Chemical Society and by representatives of scientific institutions invited by the Ministry of Supply.

ATOMIC ENERGY COMMISSION

IN view of the fact that the organisation of work in the nuclear sciences in India would require suitably trained scientists in large numbers in the near feature, the Atomic Energy Commission recently convened a Conference of some of the leading scientists in the country to consider what steps should be taken to meet this demand. Since the universities would naturally be the proper nurseries for training such personnel, all universities and prominent research institutions were invited to send delegates to this Conference, which met in New Delhi, on the 21st and 22nd January. Prof. H. J. Bhabha, Chairman of the A.E.C., presided over the deliberations. The important decisions reached at the Conference were: (1) Steps should be taken immediately to draw up a uniform and suitable syllabus for the teaching of theoretical and practical physics, mathematics and chemistry in Indian Universities; (2) Refresher courses, like summer schools, should be organised for willing teachers of the universities so that the suggested syllabus may be taught in the universities by them.

By way of implementing the first decision, the Conference appointed a Committee to go into the question of drafting a suitable syllabus for theoretical physics, experimental physics and chemistry going up to the M.Sc. standard which could be easily adopted by the universities without the necessity of radically changing the existing curricula overnight.

The following were nominated on this Committee:—Dr. S. N. Bose, Dr. D. S. Kothari, Dr. R. C. Majumdar, Dr. N. R. Sen, Dr. R. S. Krishnan, Dr. D. M. Bose, Dr. H. J. Taylor, Prof. S. Bhargava, Dr. Mata Prasad, Dr. G. P. Kane, Dr. P. B. Sarkar and Dr. Jagdish Shankar.

ISOTOPE PRODUCTION

BRITAIN'S large atomic pile has just started work on the production of radioactive isotopes.

When operating at full power it will be able to produce all the artificial radio-active isotopes required by medical, industrial and other research workers in the U.K. as well as increased supplies for export, for which a steadily increasing demand is anticipated.

Opened at Britain's Atomic Energy Research Establishment at Harwell in July last year,

The following are the terms of reference of the Committee:—

1. To scrutinize the syllabus of teaching in Physics, Chemistry and Mathematics in the different Indian universities and to make recommendations with the object of bringing these courses to the level of modern standards. The Committee will pay special attention to the inclusion of basic knowledge in each subject which every student should know. The Committee will also draw up more advanced courses for those who specialise in atomic sciences.

2. To circulate the courses drawn up by the Committee to all the universities for suggestions and on receipt of replies, to submit a final report to the Atomic Energy Commission.

3. To examine whether the courses suggested by the Committee can be divided conveniently into under-graduate and post-graduate courses.

4. To submit a preliminary report by the end of February 1949 so that the document could be communicated to different universities well in advance before the commencement of the next academic year.

It may be pointed out the decisions arrived at this Conference called by the A.E.C. when implemented, will constitute a concrete step in organisation and development of the atomic sciences in India. This is perhaps the first time that representatives from all the teaching and research institutions in India have met together to formulate uniform syllabi for physics, mathematics and chemistry for adoption by all Indian universities. It is earnestly to be hoped that the lead given by the A.E.C. will be followed by other groups of sciences.

the pile has a rated output of 6,000 kilowatts and was designed primarily for experimental purposes. Materials which it irradiates will be 20 times more active than those so far irradiated.

Radio-active isotopes have already been delivered by Harwell to various research institutions, including hospitals, universities and industrial organisations in the U.K. and abroad.

The first deliveries from this large pile will start early in March.

ANIMAL HUSBANDRY WING MEETING OF THE BOARD OF AGRICULTURE AND ANIMAL HUSBANDRY

(Indian Council of Agricultural Research)

THE Eighth Animal Husbandry Wing Meeting, which was held at Mysore during the third week of February 1949, was inaugurated by His Highness the Maharaja of Mysore. His Highness emphasised the part played by the cattle in the economic well-being of this country from very ancient times and outlined the problems facing the country to-day.

This meeting which was presided over by Sardar Datar Singh, was of special significance at this juncture when the balance of cattle wealth has become rather unfavourable due to the partition of the country. The Province of Sind is the home of several important milch herds and as things stand to-day their import has almost ceased. The effect of this is already felt, and per capita supply of milk which stood at 5.8 oz. before partition has dropped to 5.2 oz. On the other hand the import of milk products like butter, condensed milk, milk powder and cheese is increasing rapidly day by day. The Wing specially considered this loss to the cattle wealth, and far-reaching suggestions were made to conserve the available stock of animals of all-India breeds. It was proposed to establish large cattle farms of such breeds in suitable areas, creating 'key village' areas to help the multiplication of better quality of cattle, and set up a Special Board with necessary statutory and functioning powers to look after the well-being of the cattle wealth. A closely interrelated proposal was also adopted in the form of setting up of "key village" areas in different parts of every Province and State where intensive cattle-breeding work could be carried out. Shortage of proven sires is the biggest obstacle to cattle development. As things stand to-day only one sire is available where 250 are required. To overcome this obstacle the plan envisages that the available pure-bred bulls should be concentrated in selected key villages taking into consideration the nature of breed most suitable for that area, to cross with the available stock in that area. Simultaneously, steps will be taken to enforce by legislation compulsory castration of bulls in these selected areas. The graded stock produced will be available from the very first generation to grade up the original stock. In the key village area itself the indigenous stock after the fifth

generation will be almost as good as pure-bred stock, and thus work will be gradually extended to other areas, with the result that in course of the time each village could become a breeding centre instead of relying on a few farms as at present. The plan thus aims at improving the existing stock on a much larger scale than is possible just now and may truly be called a milestone in the cattle improvement schemes that have been formulated so far.

The work carried out, with cows and buffaloes, at a few selected centres on artificial insemination has given very promising results. It was therefore proposed that this method should be now utilised widely for improving cattle. In the beginning it will no doubt be necessary to exercise caution and extend the work step by step to avoid disappointments later.

Along with breeding, an equally important problem is to find ways and means of augmenting the present inadequate supply of feeding stuffs for cattle. Shortage of feeding stuffs is one of the biggest obstacles facing the cattle industry, which, if not tackled properly, will upset any plan for cattle improvement and production of more milk. The subject received careful consideration at the meeting and the proposal was made that in view of the fact that at present a large number of cattle live only on the agricultural residues, means should be found to devote a certain portion of the land where irrigation facilities exist and that which the Government is proposing to develop, for growing fodder. Fodder should also be grown by proper rotation on the existing land. Utilisation of leaves and seeds of fruits by processing or otherwise, making use of materials such as entrails, blood, bones, etc., creating fuel and fodder plantations, conserving grass during the monsoon seasons in the form of silage—were some of the methods suggested. It was recommended that the present practice of exporting oil-seeds should be discontinued early and seeds should be crushed in villages so that cakes will be available for use as cattle feed. The practice of extracting oil from oil-cakes by solvent extraction needed to be discouraged as there was no justification for assuming that our cattle get an adequate amount of fat and calories in their diet from other sources. If the use

of oil-cakes for manuring was stopped, wherever possible, that will release considerable quantity of concentrates for cattle. The rôle of trace-elements in animal nutrition is a subject that has not been investigated in any great detail, as also the toxicity of plants consumed by the animals during grazing. It was therefore recommended that these two subjects should be investigated in detail.

The meeting also considered the need for the improvement of cattle in hilly areas and decided to appoint a Special Committee to survey the problem, especially in areas where indigenous breeds fail to thrive.

The Wing suggested steps that should be taken to reduce the mortality amongst young calves, which is a constant drain on some of the potentially best cattle. Apart from the various diseases which are responsible for this heavy loss, it was emphasised that the problem was largely an economic one, and unless breeding of live-stock was made profitable, other remedial measures cannot be expected to bring the desired changes in the existing practices. It was therefore recommended that where possible calf farms should be started where calves

may be reared and looked after properly till maturity. Different practices for rearing of calves are followed in different parts of the country. It was therefore decided to survey these methods so that when the experience of all the breeders is pooled together it may be possible to evolve a cheap method for raising calves.

It was recommended that in view of the growing number of centres where various veterinary biological products are manufactured, and also because of the large import of these products, it was necessary to set up an organisation with statutory powers to lay down standards and check the quality of these products. Such an organisation is overdue and it is hoped that early action will be taken on the lines of the existing Drug Acts from which veterinary products are excluded now.

The question of veterinary education was also discussed. It was emphasised that the standard of training should not only be uniform, but as high as possible. The setting up of an Indian Veterinary Council was recommended to safeguard the interests and integrity of the veterinary profession.

IMPROVEMENT IN METHODS OF DATING*

IN the field of architectural history, the Method of Seriation has uniformly been followed for purposes of dating. With the help of buildings, of which the dates are known from independent evidence, an evolutionary series is first built up; and then temples of which the dates are not known, are assigned dates according to their nearness to one or other of the landmarks in the scale. The assumption in Indian Architecture has been that the whole of India can be treated as one unit in evolution, and that evolution itself has been unilateral. Different workers like Fergusson or Rakhaldas Banerji have only differed from one another in their choice of elements used for building up the scale of reference; but the fundamental assumptions have been uniform.

Professor Bose suggests that this method of treating the whole of India as one evolutionary unit, and the dependence on

unilinear evolutionism is not justified. There is evidence to show that in different regions, temples have followed slightly different courses of evolution. Moreover, the structural elements of temples have also changed, not uniformly, but at varying rates.

Professor Bose has tried to apply the Distribution Method for finding the relative age of those elements. He proposes that, in each region of India, the dated temples should be taken up, subjected to a uniform scheme of analysis, and an independent scale of evolution built up with their help. When this work has been accomplished in different provinces of India, the findings arrived at by a reliance upon the Distribution Method should be compared with the above result. Only then shall we be in a position to assess the value of the latter method, as well as check the results arrived at by previous workers in the field, who relied on a belief in the uniformity of evolution.

Research workers in different areas can thus be of help to one another in bringing more precision into methods of dating.

* Summary of the Presidential Address delivered by Professor Nirmal Kumar Bose, to the section of Anthropology and Archaeology during the 36th Session of the Indian Science Congress held at Allahabad, January 1949.

A REGIONAL METALLURGICAL RESEARCH LABORATORY FOR WESTERN INDIA

AN IMPASSIONED plea for the establishment of a centre for industrial metallurgical research to meet the industrial needs of Western India was made by Prof. N. P. Gandhi in the course of his address before the Bombay Metallurgical Society, at Bombay. Every metallurgical factory, he said, must needs get problems to solve from time to time. "Sometimes a furnace is not giving the required temperature; sometimes the fuel or energy consumed is excessive; sometimes the refractory material fails in an unaccountable manner; sometimes the metal produced has too many blow-holes or other defects; sometimes the metal cannot be rolled well; sometimes the dies, rolls, etc., wear too quickly or break too often; sometimes the rejection of castings is too great to leave a margin of profit; sometimes a tool or machine part is not functioning properly due to faulty heat treatment; sometimes a metal is oxidising badly, and so on. Scores of such instances will occur to most factory workers. How are these problems to be solved? By shutting our eyes to them? By blaming ill-luck? By putting up with them as something mysterious or unsolvable? No. They can be investigated into. In most cases a clue and a way out can be found at a sufficiently low cost. Only we must have a testing laboratory, a band of investigators and the will and perseverance to solve.

Most small factories cannot afford to have a research laboratory of their own. They would probably have more technical problems to solve than the larger factories. Even if they can afford the equipment, they cannot afford the salary of a whole-time staff. What then are they to do? The answer is: Co-operate with other factories in the trade. Here comes in the question of competition. One factory owner often does not want the others to know what his problem is and what solution he has found for it. Can this necessary secrecy be safeguarded in a research laboratory put up jointly with others in the trade? The answer is: yes. If you ask how, here is an answer.

Suppose 20 factories in a trade jointly raise a sum of two lakhs of rupees for a co-operative industrial research laboratory. (Nowadays amounts can be contributed

for such projects free of income-tax.) It is likely that the Government will make a contribution of an equal amount towards such an effort. But suppose that the Government contributes only half, i.e., one lakh of rupees. This will make it three lakhs. A building can be hired at first. About two lakhs of rupees worth of equipment can be installed, including machines for testing tensile strength, hardness, impact resistance, fatigue, corrosion, etc., an analytical laboratory, a metallographic laboratory, pyrometers both indicating and recording, Orsat apparatus, carbon dioxide recorders, heat treatment apparatus, a small workshop and a library. The industry would have to pay a small cess on its sales to meet the cost of a small permanent research staff consisting of 3 or 4 members. When not engaged in solving any particular firm's problems, the small permanent research staff can remain busy solving general problems pertaining to the industry as a whole. Attached to the research laboratory there should be a certain number of vacant rooms having separate entrances and fitted with gas, water, electricity and laboratory furniture. Any member-firm wanting to solve a problem can hire one of the vacant rooms for a period and borrow or have access to the necessary equipment and stores in the common stock. It should be open to the firm to make use of the permanent research staff on partial payment if it so desires. It should be likewise be open to the firm to bring its own staff for solving its problems either from its own factory or specially recruited by it for the purpose, or both. It should only be necessary for the research department to see that the staff brought is sufficiently qualified to use the borrowed equipment properly. At the end of the work the borrowed equipment and stores are to be returned. No charge should be made to the firm for the common capital equipment used for the research. The only charge should be in respect of the stores and energy consumed and for any damage caused. The firm need not divulge what problem it investigated and with what results.

The cost of solving a problem in such a manner would only be a fraction of what the firm would have to spend if it was to

buy all the necessary instruments, apparatus, etc., fit up a temporary laboratory for the research, dismantle it and dispose of it when the work was over. If the scheme of co-operative industrial research succeeded, more money would flow in and further

equipment such as a spectrograph, a polarograph, an X-ray unit, etc, could be added and even a permanent building put up. If it failed, there would probably be little difficulty in disposing of the standard units of the equipment.

THE INDIAN COUNCIL OF THE BRITISH EMPIRE LEPROSY RELIEF ASSOCIATION—ANNUAL REPORT, 1947

THE All-India Leprosy Workers Conference, the first of its kind in India, held its successful session in Wardha. The increasing interest taken by Provincial Governments in anti-leprosy work was highly gratifying. The research activities were conducted in collaboration with the Endowment Fund of the School of Tropical Medicine, Calcutta, and the Indian Research Fund Association. The summary of the researches included:—

1. *Therapeutic studies:* Sulphones, Promins and diazone, in leprosy, were found to yield some results in certain cases of lepromatous cases with ulcers and eye-complications and in those who cannot stand injections of hydnocarpus oil. The drugs mark a definite advance in the treatment of leprosy.

2. *Clinical Study:* A study on the eye-lesions in leprosy has been completed the useful data collected indicating two main types of eye-lesions in leprosy. 200 cases were studied of which 116 were neutral cases; of these 92 were bacteriologically negative, 24 positive, only two cases had complete loss of sight in one eye. Of 80 lepromatous cases examined, 58 were fairly intensive, 22 advanced, complete loss of sight was noticed only in two cases. This finding indicates that eye-lesions in leprosy in India is a rare condition.

3. *Bacteriological studies:* Dr Rao's claim for successful cultivation of *M. leprae* in symbiosis with *leishmania* culture could not be confirmed.

4. *Transmission of leprosy by cockroaches:* Dr. Moiser, a Rhodesian leprosy worker suggested that cockroaches are responsible for transmission of leprosy, but this view could not be confirmed by results of the experiment carried out at the School of Tropical Medicine, Calcutta.

Useful findings were obtained in a correlation study of clinical, bacteriological

and immunological aspects of leprosy. Other activities included teaching and routine clinical work.

Among the Provincial branches the scope of the work was enormously widened in Madras. There were 12 important inpatient institutions in the Province besides facilities for admission and treatment in different Headquarters hospitals. In the field of investigation, child leprosy received considerable attention. In Saidapet, a Child Clinic was established exclusively for child leprosy enquiry and valuable data regarding incidence of the nature of the disease were collected. It was elicited that the majority of leprosy cases in children under ten years formed a group of 'prelepromatous leprosy' or incipient lesions of childhood. They were kept under observation without treatment and most of them showed spontaneous improvement. It was also found that the closer and more prolonged the contact with leprous cases, the more serious the form of the resulting disease. Another valuable observation was that the incidence of leprosy was decreasing in villages where night segregation of infective patients was enforced and increased in the corresponding groups of villages where there was no night segregation. In the survey work in the endemic districts it was found that in the highly endemic area child-rate varied from 10% to 73.8% of the total cases. In the sphere of treatment with sulphone group of drugs there was some promise in certain type of cases as was previously observed. Some ayurvedic remedies reported to be of use in leprosy were tried without encouraging results. The Provincial Government, the Indian Council of British Empire Leprosy Relief Association and Mission Institutions, have share in the Anti-Leprosy campaign in the Province.

K. P. MENON,

COLLOIDS IN BIOLOGY AND MEDICINE*

THE address deals with certain aspects of colloid chemistry with special reference to biological processes. Colloids offer a fruitful meeting ground for the different branches of Science; its manifold applications not only to industry but also to biology and medicine have made it of vital importance to the biologist and the physiologist. Colloid technique offers powerful tools to probe into the nature of isolated growing cells and tissues and leads to a better understanding of the types, the mechanism of sub-division, their movements and the factors affecting the nutrition of cells, muscle, and blood. A purely biological approach to the study of these problems is inadequate. A typical instance in point is the study of the protoplasm. Protoplasm has been defined as the material basis of life and it is only when the knowledge of the biologist on its behaviour, the results of the chemist regarding its constitution, investigations of the Colloid chemist on the state of dispersion and aggregation and the experience of the physicist regarding energy propagation in an essentially dynamic system are all woven together that a fabric giving a comprehensive picture can be obtained. Predominant colloid characteristics like electric charge, cataphoretic migration, iso-electric point, coagulation, peptization, adsorption, and membrane permeability have been shown to play a fundamental rôle in most vital processes. There is thus a clear indication that the future development of colloids will be mainly in its application to living matter and life processes.

An interesting aspect of the subject is the study of the formation of structures like muscle fibres, bones, gall-stones, etc., in the living organism. These structures are closely related to periodic precipitation in gels. Similar physical conditions regarding diffusion, supersaturation, presence of a gel medium, formations in a colloidal state, are operative in both cases, and thus it becomes possible to explain the genesis of gall stones and other growths in the animal body in the same manner as in the

formation of periodic precipitates. Thus, during inflammatory conditions, cholesterols in animal body separate along with calcium bilirubinate as a colloidal mass in the first instance. These change to a crystalline form by a process which is analogous to crystallization in a gel and thus concentric deposition, which is characteristic of reactions in a gel, is produced. The formation of shells, mother of pearl, and various types of concretions have many points of similarity with periodic precipitation. Synthetic elements produced by slow decomposition of calcium bicarbonate held in a gelatine gel give fine periodic layers of calcium carbonate with a spacing of about 4000—6000 per cm. and display the colours of natural mother of pearl. It may be considered that the alternate layers of aragonite and concholinine in the mother of pearl are formed by a process of periodic precipitation.

Radiations act variously on colloids. They may lead to periodic deposition, photophoresis, and changes in the state of dispersion resulting both in a finer subdivision of the particles and in coagulation. Photoelectric affects may take place followed by secondary effects like increase in conductivity and decrease in viscosity but in many cases the behaviour is better explained on the basis of photochemical changes which alter the conditions of the protecting layer and thereby reduce or neutralise the charge on the particle. These experiences from the study of colloids *in vitro* have their significance in the use of irradiations *in vivo* which affect colloidal materials of the living body.

The behaviour of colloids towards light is linked up with several branches of actino-therapy particularly in relation to deficiency and metabolic diseases. Though the emphasis in the therapeutic use of radiations has been more on the physiological side, a colloid-chemical approach to the subject is bound to prove profitable.

Adsorption offers another point of contact between colloid phenomenon and biological processes. There is no dearth of experience where the cells of the living body act as adsorbent. The role of adsorption is enhanced by the highly disperse nature of the body materials and

* Abstract of the Presidential Address of Dr. P. B. Ganguly, delivered before the section of Chemistry during the 36th Session of the Indian Science Congress, held at Allahabad, Jan. 1949.

the existence of minute capillary spaces. The catalytic activity to enzymes is intimately connected with adsorption. Experiments with inorganic adsorbents have shown that the molecules in the adsorbed layer are oriented in characteristic manner. A similar process is considered to be operative in the case of enzymes, where the peculiar frame work of the adsorbed molecules resulting from orientation will produce a factor of specificity in their action. There is a clear parallelism between toxicity and adsorption, which also lies at the basis of many biological phenomenon.

Peptisation and flocculation are essential properties of colloidal systems. These principles find their applications in the diagnosis of certain diseases and the pathological examination of body fluids. It has been found advantageous to use many

medicines in a colloidal form rather than as ionogenic salts. Such a method of administration of a medicine secures a low osmotic activity and a large surface. Thus, medicine in all its aspects has made free use of colloid chemical methods.

There are many other spheres of biological activity where colloids play an important part. Again and again we find predominant colloidal characteristics like electric charge, cataphoretic migration, iso-electric point, coagulation, peptisation, adsorption, membrane permeability and many others, playing a fundamental rôle in most vital processes. Life is a continuance of the colloidal state and coagulation means death. As cytology marches onwards, many a chapter of the interplay of colloid behaviour and life processes will be revealed.

THE PATENT SYSTEM AND THE SCIENTIST*

IN the course of a thought-provoking article stressing the need for Scientists in India to pay greater attention to the Patent System than they have done hitherto, Sri. K. Rama Pai observes that Society looks up to the Scientists not only to expand the frontiers of knowledge, but also to solve numerous problems which face it, such as the economic problem of finding food and employment, the defence problem of maintaining an adequate war potential which would ensure freedom to the nation, and a thousand and one other problems which would assist men in passing through life with maximum comfort, and that the Scientist has a duty to concern himself with every factor which would be helpful to him for adapting his discoveries in the field of applied research, for utilitarian purposes.

Explaining the advantages of the Patent System, he remarks that it has been designed to encourage inventors to develop inventions from the laboratory stage to the industrial stage.

* Abstract of an article on "Patent System and the Scientist" by Sri. Rama Pai, Secretary of the Patents' Enquiry Committee, constituted by the Government of India, to the symposium on Patent System arranged at the 36th Session of the Indian Science Congress.

THE PATENT SYSTEM AND THE SCIENTIST*

Commenting on the present attitude of the average Scientist in India to the System of Patents, he says that, as a rule, the Indian scientist either views the Patent System with positive disfavour or is supremely indifferent to it, as a result whereof many inventions of great merit which were known in the past have been lost to the country, or, the resources of research have been utilised unfortunately for re-inventing what has already been invented by others.

By way of breaking down the popular prejudice on the subject, Sri. Rama Pai argues that while it is true that the Patent system gives a formal recognition to the inventor of his exclusive right to his invention, this is done only in exchange for two privileges surrendered by the inventor, namely,

- (i) The prompt disclosure of the invention to the public; and
- (ii) The unreserved dedication of the invention to the public on the expiry of the Patent.

What the Patent System actually does therefore is merely to restrict the period of exclusive right to a reasonable period of 16 years. There can be no doubt that in this transaction it is the public who get the better of the bargain in the long run.

OBITUARY

DR. YELLA PRAGADA SUBBA ROW

THE American press has paid glowing tributes to the work and achievements of Dr. Yellapragada Subba Row, noted Indian physiologist and Director of Research for the Lederle Laboratories Division of the American Cyanamid Company, who died recently at his home in Pearl River, New York, at the age of 52.

"In the death of Dr. Subba Row," says the *New York Times*, "medical research has lost one of its commanding figures". Few laymen, the paper says, knew directly of Dr. Subba Row's work—his contributions to the control of certain types of anaemia, his researches in nutrition and his investigations of drugs—but "many advances in modern medicine stand as monuments to his genius and countless thousands will benefit for years to come from investigations he set in motion and supervised".

Dr. Subba Row, according to the *New York Herald Tribune*, was regarded by many scientists as "one of the most eminent medical minds of the century". He was interested in everything from liver extracts to orchids and his work in the last twenty-five years carried him to "pinnacles reached by few medical investigators".

Born in Madras, Subba Row received his Bachelor of Medicine and Master of Science degrees from the Madras University and then took the degree of Doctor of Tropical Medicine from the University of London. He went to America in 1923 and later became an American citizen.

He was a Harvard University Fellow from 1925 to 1928 and a Rockefeller Foundation Fellow from 1928 to 1930. For a period he was an orderly at Peter Bent Brigham Hospital. His work done, he would return to his laboratory where he and other medical students would sit far into the night discussing problems in chemistry and related fields. At Harvard he studied Biochemistry under the late Dr. Otto Folin and eventually took a Ph.D. degree in the subject.

In 1936 Dr. Row became an instructor and in 1938 an Associate Professor of Biological Chemistry at the Harvard Medical School. In 1940 he was appointed Associate Director of Research for the Lederle Laboratories. Two years later he became the Research Director.

Among Dr. Subba Row's important researches were investigations which helped to revolutionise the modern concept of muscular contraction. He evolved new methods of phosphorus determination which helped to lead eventually to the discovery of organic phosphorus compounds in muscle. This discovery has thrown new light on the mechanism of muscular contraction. He also won distinction by isolating certain liver factors which resulted in the development of such products as folic acid, teropterin and other drugs. Further research in the folic acid compound led to the discovery of a number of substances related to it, like Vitamin M, Vitamin BC, Vitamin B-10, B-11 and others. These researches produced a new approach to the treatment of cancer and pernicious anaemia through nutrition.

Dr. Row aided the production of penicillin and streptomycin in large quantities during the war. He and his associates also produced the wonder drug auriomycin used in the treatment of infections which do not respond to penicillin or streptomycin. Another major achievement, one of his last, of Dr. Row was the perfection of a new specific—Hetrazan—for the cure of filariasis, a tropical disease, said to be affecting some 20 crores of people in India, Far East, North and Central Africa.

Always eager to learn, Dr. Row's curiosity was insatiable. Three years ago he decided he would systematically examine the world around him to fit together a few missing pieces in his experience. He learnt to drive an automobile. Then he learnt to ride horse. Then he learned to fly an aeroplane; won his license and made a number of solo flights. Then he became interested in bowling and tried to work out the most efficient methods of scoring strikes on the bowling alley. And in recent months he had focussed his attention on orchids and was trying to devise new ways to make them grow faster.

Dr. Subba Row, says the *New York Times*, was one of those remarkable individuals who, from time to time, becomes seriously worried about his ignorance and tries to do something about it. "Matched against the average person, or indeed the average

member of the medical profession and allied sciences, Dr. Subba Row might well have qualified as a repository of universal knowledge. But that would not have satisfied him. He yearned to know more."

Surviving are his mother, a sister and a brother, all residing in India.

SIR K. RAMUNNI MENON

DIWAN Bahadur Sir K. Ramunni Menon, M.A. (Cantab.), LL.D. (Madras), passed away on 14-1-1949. He was born at Trichur on 14-9-1872. He was educated in the Maharaja's College, Ernakulam and later in the Presidency College, Madras. He went to England for higher studies in Zoology and joined Christs College, Cambridge. When he returned to India, he was appointed to the Madras Educational Department in 1898. He became Professor of Zoology in the same College in 1910 and continued in that capacity till 1927 when he retired. In a College which was noted for discipline in those days Prof. Ramunni Menon's Department held the field. His lectures on the most difficult subjects in Zoology were characterised by lucidity of expression. He loved to see his students do their practical work with cleanliness and accuracy. He was keen on research and for several years interested himself in the study of certain forms of coelenterates. He was cautious to a degree with the result that he was not able to produce that amount of research work that one might have expected. His administrative duties also weighed him down and he could not devote enough time to his research work. He himself felt this and this in a way made him anxious to create conditions for others which would enable them to make substantial contribution to Zoology in South India. This idea took firm possession of him about the year 1927 when he began to think seriously of establishing University research laboratories not only for Zoology but also for Botany and Bio-chemistry. He planned out the three laboratories and as Vice-Chancellor of the Madras University during 1928-34, he was

able to put through the scheme and had the satisfaction of seeing its completion before he laid down office. It is to his great exertion and forethought that we have these three research laboratories. Zoology in South India owes a great debt of gratitude to him.

The new University buildings were also completed during his term of Vice-Chancellorship. It has been said with justice that this fine pile of buildings has been due to a great extent to the way in which he husbanded the resources of the University before and during the construction of the buildings. He was nominated life-member of the Senate of the Madras University. He was also nominated member of the Madras Legislative Council on two occasions. He represented the Madras University at the Congress of the Universities of the Empire at Edinburgh, in 1931. He was Chairman of the Inter-University Board, 1932-33, and member, Council of State, India, from 1934 till the Council was dissolved.

Sir K. Ramunni Menon was not one of those people who courted lime-light. His field rather lay more particularly in honest unostentatious work. He believed in hard work and expected others to put forth their very best endeavour. He was conservative in his views and believed in the orderly development of society.

After retirement he interested himself in music and the study of Samskrit. He loved his native tongue, Malayalam. He lived a very useful and strenuous life and those who know him well, his students and others, will always remember him with respect and hold him in great esteem.

R. G.

LETTERS TO THE EDITOR

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THE BAND SPECTRUM OF CHROMIUM CHLORIDE

THE band spectrum of Chromium Chloride which is prepared for the purpose, using a pure 'Kahlbaum' specimen of chromium, has been excited in the heavy current generator discharge maintained at 1500v, 1 A., in a specially designed quartz discharge tube. Five prominent groups of bands are obtained in the region λ 6400-5700. The bands are line-like and appear very similar to the system of MnCl, obtained in our laboratory, in the region λ 4000-3600. The bands show a complex intensity distribution, and are assigned to the electronic transition ${}^6\pi - {}^6\Sigma$, involving high multiplicity terms. The average separation between the components of the ${}^6\pi$ level is obtained as 44 cm.⁻¹, and the values of the vibrational frequencies for the lower and the upper states are :

$$\omega_e'' = 291 \text{ cm.}^{-1}$$

$$\omega_e' = 362 \text{ cm.}^{-1}$$

Details will be published shortly.

Andhra University, V. RAMA KRISHNA RAO.
Waltair,
February 18, 1949.

VANADOMETRY—PART I
Volumetric Estimation of Ferrous Salts in the Presence of Alcohols

Viswanadham and Gopala Rao¹ have shown that the reaction between ferrous salts and chromic acid induces the reaction between oxalic acid and chromic acid; if a solution of potassium dichromate is employed for the volumetric estimation of ferrous salts in the presence of oxalic acid, the amount of dichromate consumed will be found to be too high. Citric acid has also been shown to interfere by a similar induced mechanism. Gopala Rao and Viswanadham² have shown that the estimation of ferrous salts in the presence of oxalic and citric acids can be accurately carried out by titration with a solution of sodium vanadate.

Extensive investigations have now been initiated to demonstrate the wider application of sodium vanadate as a volumetric reagent and to bring out its exclusive features, if any, when compared with other reagents. We have now found that ferrous salts cannot be accurately estimated by potassium dichromate in the presence of alcohols like methyl, ethyl, isopropyl and *n*-butyl alcohols, the values obtained

being too high. This has been shown to be due to the fact that the reaction between ferrous salt and chromic acid induces the reaction between the alcohols and chromic acid. The excess dichromate solution consumed depends upon various factors, such as the speed of titration, the relative concentrations of ferrous salt and alcohol, the acid concentration, etc. The results recorded in the following table show that the estimation of ferrous salts in the presence of alcohols can be made with accuracy by using a standard solution of sodium vanadate in place of the dichromate solution.

TABLE I

Composition of solution		Amount of ferrous iron found by dichromate method	Amount of ferrous iron found by author's method
Amount of ferrous iron taken	Amount of alcohol solution		
milli mols.	milli mols. of methyl alcohol	milli mols.	milli mols.
0.2259	10.0	0.2536	0.2260
0.4517	10.0	0.5070	0.4518
0.4517	25.0	0.5596	0.4518
0.9034	10.0	0.9713	0.9036
milli mols. of ethyl alcohol			
0.2397	20.0	0.2887	0.2384
0.4793	20.0	0.5720	0.4792
0.4793	50.0	0.6596	0.4792
0.9586	20.0	1.098	0.9560
milli mols. of isopropyl alcohol			
0.2160	30.0	0.2352	0.2159
0.4319	30.0	0.4511	0.4319
0.4319	75.0	0.4840	0.4319
0.8638	30.0	0.8913	0.8638
milli mols. of <i>n</i> -Butyl alcohol			
0.2186	20.0	0.2411	0.2188
0.4319	30.0	0.4511	0.4319
0.4319	75.0	0.4840	0.4319
0.8638	30.0	0.8913	0.8638

Sodium vanadate has thus some special advantages over potassium permanganate and dichromate as a volumetric reagent. It can be used for the estimation of ferrous salts in the presence of oxalic acid, citric acid and the alcohols, where potassium permanganate and potassium dichromate give too high results. Moreover, sodium vanadate solutions can be easily prepared and preserved over long periods without change in titre, unlike potassium permanganate. Ammonium vanadate supplied by Schering Kahlbaum, Merck or B. D. H. has been found to be quite pure. The requisite

quantity of the salt is weighed out carefully into a conical flask, dissolved in distilled water, a slight excess of pure sodium carbonate added and the solution boiled until all the ammonia is driven out. The resulting solution is cooled and transferred to a litre measuring flask and made up to the mark. The strength of the solution is checked up by titration against a standard solution of ferrous ammonium sulphate, using diphenylamine or diphenyl benzidine as internal indicator. A standard solution of sodium vanadate prepared in this way is remarkably stable, especially when containing a slight excess of sodium carbonate, about 0.1 per cent.

Detailed results are being published elsewhere.

G. GOPALA RAO.

J. V. S. RAMANJANEYULU.

Andhra University,

Waltair,

November 20, 1948.

1. Viswanadham and Gopala Rao, *Curr. Sci.*, 1943, 12, 327. 2. —, *Ibid.*, 1944, 13, 180.

REDUCTION OF NITRO GROUP TO AMINO GROUP BY 'HYDRO' IN ALKALINE MEDIUM

THE aromatic amino compounds are useful substances in synthesis as well as in industry. They are prepared by the reduction of the corresponding nitro compounds, the reducing agent used generally being a hydrogen-generating combination of metal and acid; the other reducing agents lead either to the production of hydroxyl-amines, azoxy or azo compounds.¹ Electrolytic reduction also gives different products depending upon the conditions used.²

In connection with other synthetic work, certain amino compounds (e.g., 5-amino-salicylic acid, 6-aminocresol, etc.) were required in quantity. The usual reduction by means of tin and hydrochloric acid did not lead to the desired product in satisfactory yield. Sidgwick and Callow have obtained *p*-amino phenol by incipient sodium hydro-sulphite using sodium sulphite and zinc.³

We thought of using sodium hydro-sulphite (hydro) ($Na_2S_2O_4$) directly as it is easily available and is being used in industry for the reduction of anthraquinone and indigoid derivatives to leuco compounds.⁴ The preliminary experiments were tried and the reduction yielded the

amino compound in excellent yield. It was then considered worthwhile to explore this method of reduction of nitro compounds with a view to its suitability as a general reducing agent for the production of amino compounds from the corresponding nitro derivatives.

Grandmougin⁶ has used it as a convenient reducing agent in connection with azo compounds. He has also tried it in the reduction of compounds other than those containing azo group. He obtained aniline in very poor yield by the reduction of nitro-benzene by this method and therefore he did not prefer it.

We have now investigated the reduction of several nitro compounds substituted as well as unsubstituted by means of hydro in 50% alkali solution. In all the cases (except nitro-benzene) we have been able to reduce the nitro compounds to the corresponding amino compounds in yields varying from 50-75%. The reaction is smooth and no elimination of the group takes place as recorded in literature in some cases.⁶

The general method of reduction is outlined below:

In a round-bottomed flask of suitable size with a mechanical stirrer, nitro compound (1 mol.) was suspended in water (nearly five times the quantity of the nitro compound) and was gradually heated with stirring to 55-60° C. Sodium hydroxide (50%) solution was added in slight excess; the sodium salt separated in case of phenols and hydroxy acids; finely powdered hydro (3.3 mols.) was added in small instalments (2-3 grams) at a time with continuous stirring. First, the sodium salt if any went into solution: the colour of the charge underwent different changes as the reduction proceeded. Finally, nearly colourless solution was formed indicating the completion of the reduction. The reduction generally takes about an hour or so. In order to ensure the completion of the reaction, the stirring was continued for half an hour more. The unchanged hydro was then filtered off. The filtrate was exactly neutralised by an acid when the amino compound usually separated out. The reduction product obtained was purified and its identity established either by mixed melting point or by preparing its functional derivatives.

In all, fifteen different nitro compounds

have been thus successfully reduced to the corresponding amino compounds.

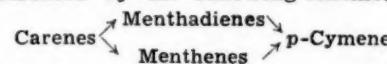
The full details of the paper will be published separately.

M. R. Science Institute, G. G. JOSHI.
Gujarat College, Ahmedabad, N. M. SHAH.
January 8, 1949.

1. Gilman and McCracken, *J. Amer. Chem. Soc.*, 1929, **51**, 821; Fry and Cameron, *J. A. C. S.*, 1927, **49**, 865. 2. Dey, Govindchari and Rajagopalan, *J. Sci. Ind. Res.*, 1946, **4**, 559, 637; *ibid.*, **5**, 75; Kondo and Nakajima, *J. Pharm. Soc. Japan*, 1922, 355. 3. Sidgwick and Callow, *J. Chem. Soc.*, 1924, 522. 4. Rogers, U. S., 1929, 1721, 319. 5. E. Grandmougin, *Ber.*, 1906, **39**, 2495; *ibid.*, 1908, **39**, 3561; 4384. 6. G. Ghielmetti, *Farm. Scie. e tech.*, 1948, **3**, 51; *C. A.*, 1948, **42**, 4553.

p-CYMENE FROM CARENES

INTRODUCTION: Though the disproportionation of carenes into p-Cymene is represented by the simple equation $C_{10}H_{16} \rightarrow C_{10}H_{14} + H_2$, the mechanism involved in the aromatisation is far more complicated. The fission of the trimethylene ring in the carenes leads initially to the formation of hydrocarbons which have the same carbon framework in the nucleus as of p-Cymene^{1,2}. Subsequent ejection of hydrogen gives p-Cymene. Neglecting hydrogenolysis and other secondary processes, and also of the possibility of arriving at p-Cymene by the migration of the isopropyl chain of the o-derivative^{3,4}, the reaction series from carenes to p-Cymene may most simply be represented by the following scheme:



This is an investigation on the possible technical production of p-Cymene by vapour phase dehydrogenation of carenes of the Indian turpentine oil, *P. longifolia*, using silica gel as catalyst.

Experimental: Vapours of carenes (b.p. 163-68° C./745 mm., d_{15}^{20} : 0.8468, n_{D}^{20} : 1.4716, $[\alpha]_D^{24}$: 21°-42°) are passed over the catalyst bed in the pyrogenic unit previously described^{5,1} at temperatures varying from 300-450° C. and at an hourly liquid space velocity of 0.14.

Preparation of the Catalyst: Ferrous sulphate (100 gm. in 500 ml. water) is stirred into sodium silicate (d.: 1.32; 100 gm. in 600 ml. water) until the precipitation is complete. Washed the precipitate several times with water, and then decomposed by

dilute sulphuric acid with gentle heating. The silica thus formed is washed with water free of sulfate, dried 12 hours at 100-110° C., and finally dehydrated 3 hours at 350° C. in the reaction furnace. Pieces of the catalyst 8-10 mesh size are used in the pyrolytic experiments.

In the table is given the results obtained at different temperatures after a single pass of carenes over the catalyst.

Pyrolysis temperature $\pm 15^\circ \text{C}$.	<i>p</i> -Cymene		
	%	d_{15}^{18}	n_D^{20}
300° C.	24.8	0.8590	1.4829
350° C.	23.0	0.8592	1.4839
400° C.	25.0	0.8602	1.4869
450° C.	16.3	0.8683	1.4934

Thus it appears that in the vicinity of 400° C. there is the optimum conversion of carenes into *p*-Cymene.

Tech. Chem. Laboratory, JAMES VERGHESE, Forman Christian College, H. K. SONDHI. Lahore, BHARAT BHUSHAN. M. L. JOSHI.

February 1, 1949.

1. Sondhi, Bhushan, Gulati and Joshi, *J. Indian. Chem. Soc. (Ind and News Ed.)*, 1947, 10, Nos. 1 and 2, 17. 2. Sondhi, Bhushan, Gulati and Joshi, *ibid.*, 1947, 10, Nos. 1 and 2, 24. 3. Zelenski and Lewina, *Ann.*, 1929, 476, 60. 4. Guha, Roy and Paul, *J. Indian. Inst. Sci.*, 1944, 26A, 1. 5. Vergheese, Bhushan, Gulati and Joshi, *J. Indian. Chem. Soc. (Ind. and News Ed.)*, 1944, 7, No. 2, 93.

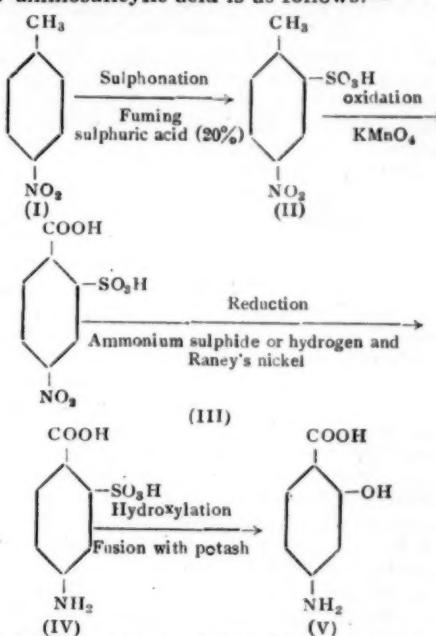
A NEW SYNTHESIS OF *p*-AMINO-SALICYLIC ACID

THE preliminary communication of Lehmann¹ on the treatment of human tuberculosis with *p*-aminosalicylic acid led many chemists and pharmacologists to undertake a detailed study of this acid. Since then *p*-aminosalicylic acid has gained considerable importance in the chemotherapy of tuberculosis.² Clinical experience with the acid has amply confirmed Lehmann's findings and has shown that the acid which is well tolerated by man is remarkably effective in the treatment of pulmonary tuberculosis and of tubercular empyæma.³

p-Aminosalicylic acid⁴ is prepared by the reduction of *p*-nitrosalicylic acid, which itself is prepared by a number of methods.⁵ All these methods are very tedious and as such alternative methods have been investigated for its preparation.⁶ Most of

these involve direct carboxylation of *m*-aminophenol using modified Kolbe's method, giving *p*-aminosalicylic acid and not *p*-hydroxy-anthrаниlic acid.

Our scheme of work for the synthesis of *p*-aminosalicylic acid is as follows:—



p-Nitrotoluene (I) is sulphonated with fuming sulphuric acid (20%) to yield 2-methyl-5-nitrobenzene sulphonic acid (II).⁷ The potassium salt of this acid is oxidised with dilute permanganate solution (4.3%), to the corresponding 4-nitro-2-sulphobenzoic acid (III).⁸ This on reduction with ammonium sulphide⁹ or with hydrogen and Raney's nickel (150 lbs. p.s.i.) gives 4-amino-2-sulpho-benzoic acid. In all these operations the yields are almost quantitative. Alkali fusion, carried out for the first time now, of the dipotassium salt of 4-amino-2-sulphobenzoic acid (IV) at 250° C. gives about 50% yield of *p*-aminosalicylic acid (V). The details of the fusion experiment are as follows.

The dipotassium salt of 4-amino-2-sulphobenzoic acid (IV) (10 g.) which has been thoroughly dried was added in small lots to hot molten potassium hydroxide (20 g.) in a nickel crucible maintained at a temperature of 250-60° C. The fusion mixture was well stirred during the reaction. The reaction was over in about 4

minutes. The cold melt was leached with water (100 c.c.) and the solution was filtered. The filtrate was chilled to about 10° C. and acidified with hydrochloric acid till it was acid to congo red. The aminosalicylic acid which had separated was extracted with ether and ether extract dried with anhydrous sodium sulphate. On removal of ether the acid separated out as a light cream coloured powder; yield 2.8 g. The acid was crystallised from alcohol, m.p. 145-46° (decomp.). Hydrochloride m.p., 220-21°. Found : N, 9.0, 9.2; C₇H₇O₃N requires 9.15%.

When fusion was conducted using solid paraffin (20 g.) as a diluent, almost the same yield of *p*-aminosalicylic acid was obtained. The acid gives a purple colouration with alcoholic ferric chloride and liberates carbon dioxide from sodium bicarbonate solution. The acid is sparingly soluble in water and moderately soluble in cold alcohol and ether. On heating, the acid gets decarboxylated to *m*-aminophenol. These findings are interesting when viewed in the light of the observation of J. A. Connor¹⁰ that aqueous solution of *p*-aminosalicylic acid or its hydrochloride is decarboxylated to *m*-aminophenol at temperatures above 80° C.

Attempts to hydroxylate the nitro sulphobenzoic acid by fusion with potassium hydroxide yielded only a charred product from which nothing definite could be isolated. Such decompositions of nitro compounds during alkali fusion are known.¹¹

Full experimental details will be published elsewhere.

Organic Chem. Lab., M. RAGHAVAN.
Indian Institute of Sci., B. H. IYER.
Bangalore 3, P. C. GUHA.
February 14, 1949.

1. Lehmann, *Lancet*, 1946, **250**, 15. 2. Youmans, *Quart. Bull. North-Western Univ. Med. School*, 1946, **20**, 420. C.A., **41**, 1011. 3. Martin, D. D., et al., *Nature*, 1948, **161**, 435. 4. Stedel and Bittner, *Monatsh*, 1902, **23**, 423. Kondo, H. and Nakajima, T., *J. Pharm. Soc., Japan*, 1922, **45**, 355. 5. Ullmann and Wagner, *Ann.*, 1907, **355**, 360. "Beilsteins Handbook," **14**, 592. *Ann.*, 1912, **390**, 4. 6. John, T. Sheehan, *J. Amer. Chem. Soc.*, 1948, **70**, 1665. Erlenmeyer, et al., *Helv. Chimica Acta*, 1948, **31**, 988. Martin, D. D., et al., *Nature*, 1948, **161**, 435. 7. Hart, *Am. Chem. J.*, **1**, 350. 8. Kastle, *Ibid.*, 1899, **11**, 179. 9. Hedrick, *Ibid.*, **9**, 411. 10. Connor, J. A., *Lancet*, 1948, **254**, 191. 11. "The Synthesis of Benzene Derivatives," by S. C. Bate, 1926, p. 154.

DIELECTRIC CONSTANT OF IONIC SOLIDS

THE application of Debye Clausius Mosotti equation to the high dielectric constant of solids has been shown to be theoretically unsound and practically hopeless.

Even for alkali halides no theoretical calculation of the dielectric constant is possible, because of the difficulty in estimating the internal field in a crystal (cf. Mott and Gurney, 1940). One of us (S K.K.J., 1944) has put forth a theory based upon the parallel and anti-parallel orientation (2J +1=2) in liquids and solids in a needle-shaped cavity, which yields an extraordinarily simple relationship(I) between the dielectric constant and dipole moment:

$$(\epsilon - n_{\infty}^2) \frac{M}{d} = 4\pi N \mu^2 / 3KT \left(\frac{J+1}{J} \right) \dots (I)$$

In the case of associated liquids like water, alcohols and ionic solids (rochelle salt, BaTiO₃) showing transition the characteristic temperature θ must be taken into account.

We have applied the above equation to the dielectric constants of alkali halides. The results are shown in Table I. The ionic character (*i*) as calculated by the ratio of the observed dipole to the full moment is found to be about 5% for all the alkali halides.

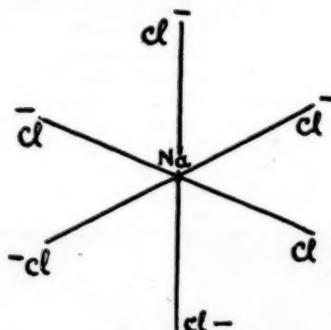
Dielectric Constant and Dipole Moments of Alkali Halides

	ϵ	n_{∞}^2	d	μ	i	$6A \times i$
NaCl ..	5.6 (1)	2.38	2.16	0.68	0.050	.52
	5.83 (4)			0.70	0.052	.55
NaBr ..	6.1 (2)	3.08	3.20	0.72	0.049	.51
	6.39 (3)			0.75	0.052	.55
KCl ..	4.5 (1)	2.22	1.97	0.67	0.045	.47
	4.8 (4)			0.71	0.047	.49
KBr ..	4.6 (2)	2.43	2.75	0.70	0.045	.47
	4.7 (5)			0.72	0.046	.48
RbCl ..	4.68 (1)	2.23	2.76	0.76	0.048	.50
	4.78 (4)			0.77	0.049	.51
RbI ..	4.51 (4)	2.72	3.55	0.75	0.043	.45
	5.0 (7)			0.88	0.050	.52

1. P. Schupp (1932); 2. Staulmann (1932); 3. S. Kyropulos; 4. K. Højendahl (1933); 5. Heydweiller (1921); 6. Starke (1897); 7. Mott and Gurney (1940).

These results can be quantitatively explained on the basis of the concept of covalent-ionic resonance postulated by

Pauling without reference to his electro-negativity theory. If we consider a six bonded unit NaCl_6 or ClNa_5 ,



and that only one bond of the six, is covalent and the remaining fully ionic, the dipole moment due to four mutually perpendicular ionic bonds will cancel as they oppose in pairs

the remaining $\text{ClNa}:\text{Cl}$ will give 0.5 ionic character for a total of six NaCl bonds. If we assume that the influence of surrounding bonds is given by Madelung constant A just as in the case of bond energy, the effective ionic character for six NaCl bonds will be $6 \times A$ times the apparent ionic character of each bond. The results in the last column for a range of the alkali halides are in agreement with the theoretical value 0.5.

The above concept that only one bond out of six is covalent in character gives $5/6$ or 83% as the value of the ionic character of alkali halides which is supported by the data on crystal energy, magneto optic anomaly, &c., as will be shown in a separate note.

Indian Inst. of Sci., S. K. K. JATKAR.
Bangalore 3, (Miss) S. B. KULKARNI.
February, 17, 1949.

1. Mott and Gurney, *Electronic Processes in Ionic Crystals*, p. 22, 1940. 2. Jatkar, *Nature*, 1944, 153, 222.

ON THE PREPARATION OF PALUDRINE (PROGUANIL)

FOLLOWING the discovery of Paludrine,¹ sufficient interest has been developed in the field of substituted biguanides as potential antimalarials. For the chemical synthesis of substituted biguanide derivatives, a number of methods¹⁻⁶ are available,

the simplest being the condensation of a substituted cyanoguanidine with an amine. For the synthesis of N^1 -aryl- N^5 -alkyl-biguanides the reaction between aryl-cyanoguanidine and alkylamine has been successfully conducted in the presence of copper sulphate or by fusion (using salt of the amine) but the desired products are not formed when the reactants are refluxed with alcohol.

During the course of investigations of N^1 -aryl- N^5 -heterocyclic biguanides,⁴ we were unable to condense certain substituted amino-heterocyclics (using hydrochloride salts) with arylcyanoguanidines in boiling alcohol. Considering that this reaction temperature may not be sufficient for reaction, iso-amyl alcohol was used instead in order to give reaction temperature of about 140°C. Although, no success was encountered in the above cases, the same procedure has been successfully employed for the preparation of paludrine as follows:

p-Chlorophenylcyanoguanidine (5 g.) and isopropylamine hydrochloride (3 g.) were refluxed together in isoamyl alcohol (15 c.c.) in an oil-bath maintained at 150°C. for 14 hours. The reaction mixture was extracted with boiling water and the aqueous portion was concentrated and chilled. Paludrine hydrochloride was collected by filtration and dried. Yield 1.5 g.; m.p. 244°.

Curd, *et al.*² have also recently prepared N^1 -*p*-fluorophenyl- N^5 -isopropyl-biguanide hydrochloride by a similar procedure, using nitrobenzene as solvent. In my experiment, replacement of iso-amyl-alcohol by nitrobenzene gave paludrine hydrochloride (3 g.), m.p. 244°.

Attempts are being made to improve the yield still further by varying the solvent and the experimental conditions.

My thanks are due to Prof. P. C. Guha and Dr. B. H. Iyer for their kind interest in this piece of work and also to the Indian Research Fund Association for the award of a Fellowship.

Organic Chem. Lab., H. L. BAMI,
Indian Institute of Science,
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March 11, 1949.

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**THE DEVELOPMENT OF
HARPACTICOID COPEPOD,
MACROSETELLA GRACILIS (DANA.)**

THOUGH the typical Harpacticoid nauplii are said to be creepers on the bottom, the nauplii as well as the early copepodite stages of *M. gracilis* (Dana.) were found clinging to floating *Trichodesmium* strands, in the Plankton in September and October. The larvae of this Copepod were grasping the algal strands considered inimical to living things by some, with the help of the well-developed antennæ or were actively crawling over these.

The eggs which are light yellow in colour and are carried in external brood-sacs, have a diameter varying from 0.06 m.m. to 0.08 m.m.

There are 6 naupliar stages as in all other Copepods. The nauplii are all coloured red owing to the presence of red pigment inside the body. The nauplius eye is present as a red-spot. The length of the nauplius at each of the six stages being 0.102 m.m., 0.130 m.m., 0.168 m.m., 0.205 m.m., 0.302 m.m. and 0.369 m.m., it will be obvious that the growth is uniform and that the increase from one stage to another is more or less mathematically constant obeying Brooks' law.

The progress of differentiation seen in the appendages through the six naupliar stages may be summarised briefly:—

Antennule: Rudimentary. Shows an increase in the number of joints at the 5th stage. **Antenna**: well developed, 2-jointed, the 2nd joint being hinged to a claw. **Mandible**: single lobed with 2 curved setae. A 3rd seta is added at the 4th stage. Posterior feeler continues to increase in size and complexity from the 1st stage when it is represented by a short bristle.

There are 6 Copepodite stages, the 6th being the adult itself. The number of segments in the body, the size of the body and the number of swimming feet present at different Copepodite stages are given in the table below:—

Stage	I	II	III	IV	V	VI
No. of joints in Metasome	3	3	3	4	4	5
No. of joints in Urosome	1	1	2	3	4	5 ♂ 4 ♀
Length in m.m.	0.484	0.616	0.742	0.922	1.01 ♂	1.1 ♂
No. of swimming feet	2	3	4	5	5	5

The increase in number and complexity of the appendages are briefly summarised thus:—

Antennule: Prominent, 5-jointed up to the 4th Copepodite stage. Geniculate and 7-jointed in the male and 8-jointed in the female from the 5th stage. **Antenna**: uniramous, 2-jointed in the 1st and 2nd Copepodites and 3-jointed from the 3rd stage onwards. **Mandible**: rudimentary. **1st Maxilla**: rudimentary. **2nd Maxilla**: indistinctly bilobed in the 1st and 2nd stages and 3-lobed from the 4th stage. **Maxilliped**: well developed, 2-jointed, the 2nd joint being hinged to a claw.



PLATE I. Nauplius 3rd stage, under high power (40 \times 10)

In the development of *Macrose tella*, the pronounced development of the antenna may be due to its prehensile function.

A full description of the developmental stages is given elsewhere.

The author thanks Dr. C. P. Gnanamuthu, M.A., D.Sc., F.Z.S., Director, University Zoology Laboratory, Madras, for his help and guidance.

University Zoology Lab., S. KRISHNASWAMY. Chepauk, Madras, November 8, 1948.

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**POST-EMBRYONIC DEVELOPMENT OF
ANTENNAE IN APHIDS**

Introductory.—The antennæ in adult aphids are usually six jointed (except in a few forms like *Tetranura ulmifoliae* Baker) with two primary sensoria, one at the apex of seg. v,

and the other at the base of the flagellum. Number of sensoria on seg. iii, iv and v are variable in different species. In all the aphids however, the scape and the pedical are the smallest of the segments.

For the post-embryonic development of antennae two species from each of the genera *Aphids* and *Macrosiphum* were under observation. The insects were bred in the laboratory on plants grown in pots of convenient size, covered over with lamp chimneys with the mouths capped with fine muslin. The observations on the antennal development were made on the offsprings from the same parents kept under identical conditions.

being sub-equal. The primary sensoria are shifted, one to the apex of seg. v and the other at the base of seg. vi.

Our observations are in conformity with those of Bhargav (1947) that the pedical does not divide in *Aphididae*. Sexena (1946) however, remarks that an increase in the antennal segments is brought about by the division of the pedical. This, however, does not hold good in *Aphididae* where the seg. iii divides by two successive divisions and thus ultimately the antenna becomes 6 segmented.

Genus Macrosiphum.—The antennae in the 1st instar nymph is 5 segmented, segments i and ii being sub-equal and the last being the

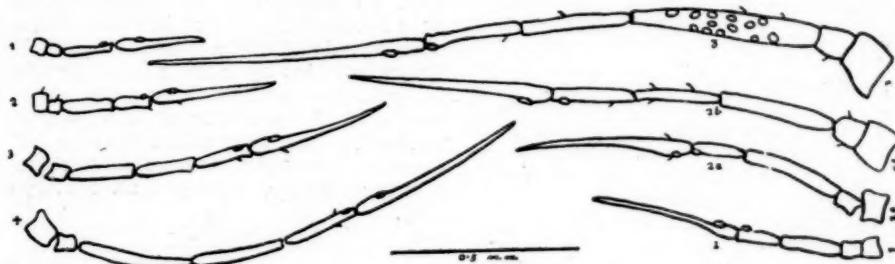


PLATE I. Antennal Development in Aphids

Genus Aphis.—On the first day of hatching the antenna is only 4 segmented, the scape and pedical are sub-equal, the last segment the longest. Primary sensoria are present, one at the apex of seg. iii, and the other near the major constriction of the flagellum. Just before the first moult, seg. iii shows a little constriction. In the second instar the antenna continues to grow showing a clear demarcation within the seg. iii. Thus the antenna is now 5 segmented, the primary sensoria previously on seg. iii is now shifted at the apex of seg. iv, and the other as usual, placed at the base of the flagellum. The flagellum in the second instar is relatively longer than in the first instar. Similarly, seg. iii has grown longer than in the previous instar. In the beginning of the third instar there are still 5 antennal segments, seg. i and ii being equal, iii longer than iv and the flagellum of the terminal segment being the longest. The primary sensoria are situated on the apex of seg. iv and the other at the base of seg. v. Prior to the next moulting however, a constriction again appears in seg. iii, thus making in all 6 segments. During the 4th instar, segments iii, iv, v and vi continue to elongate, the first two segments

longest. Primary sensoria are located, one at the apex of seg. iv, and the other compound sensorium at the major constriction of the flagellum. In the beginning of the second instar seg. ii is slightly longer than seg. i, segments iii and iv continue to elongate, and the flagellum is the longest. Seg. iii becomes uniformly thick, and a slight constriction appears. The primary sensoria are situated, one at the apex of seg. v (original iv) and the other at the base of the flagellum. Prior to second moulting, segmentation in seg. iii becomes more marked and the antenna becomes 6 segmented. During the third instar all the individual segments continue to grow, seg. iv and v are sub-equal, seg. iii longer than iv, and flagellum again the longest. The position of primary sensoria is the same as in the previous instar. In the 4th instar, seg. iii attains normal length and is longer than seg. iv or v. The individual segments continue to grow to attain their normal lengths.

Obviously the segment iii divides but only once in this case.

Summary.—Unlike in the genus *Aphis* there are 5 segments in the antenna of freshly born *Macrosiphum* nymph. The cleavage in seg. iii

is seen just in the beginning of the second instar, yet only 5 antennal segments are made out. However, the segmentation at the end of the same instar is completed and thus 6 segments are made out. The lengths of antennal segments after the division and just in the beginning of third instar are given below. The individual segments continue to grow in different instars until normal proportionate lengths are attained in their adult stage. Thus, in the third instar the number of antennal segments in *Macrosiphum* nymphs are six.

TABLE I
Measurements of antennal segments in
Aphids during different instars

Instars	APHIIDS				Remarks
	<i>Aphis</i> spp.	<i>Aphis</i> spp.	<i>Macrosiphum</i> <i>jaceae</i>	<i>Macrosiphum</i> <i>pisii</i>	
Average measurements in m.m.					
I	i 0.03 0.03 0.04 0.04	ii 0.04 0.03 0.04 0.04	iii 0.16 0.15 0.16 0.22	iv 0.26 0.23 0.12 0.22	In each case averages are derived from antennal measurements of 6 nymphs bred under observation
	v 0.41 0.57	vi			
II	i 0.04 0.04 0.04 0.06	<i>Aphis</i> : seg. iii shows clear division, splitting it into two.	iii 0.13 0.15 0.27 0.34	iv 0.08 0.09 0.15 0.28	
	ii 0.04 0.04 0.06 0.08		v 0.32 0.32 0.49 0.69	Macrosiphum : seg. iii uniformly swollen and a slight cleavage could be noticed.	
	iii 0.13 0.18 0.28 0.33		vi		
III	i 0.04 0.04 0.09 0.08	<i>Aphis</i> : Seg. iii shows thickening at base, cleavage is seen in seg. iii, seg. v now becomes vi.	ii 0.04 0.04 0.08 0.09	iv 0.08 0.16 0.22 0.36	
	iii 0.13 0.18 0.28 0.33		v 0.09 0.15 0.22 0.35	vi 0.37 0.41 0.57 0.91	In <i>Macrosiph</i> as well the full compliment of six segments is observed in this instar.
IV	i 0.09 0.06 0.09 0.13		ii 0.08 0.06 0.09 0.08	iii 0.36 0.29 0.53 1.13	
	iv 0.33 0.22 0.28 0.78		v 0.25 0.22 0.28 0.71	vi 0.58 0.50 0.77 1.35	

The difference between antennal developments in the two different genera, namely *Aphis* and *Macrosiphum*, were not noticed by Bhargava (1947).

Entomological Laboratory, K. N. TREHAN.
College of Agriculture, H. L. KULKARNI.
Poona 5,
November 19, 1948.

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DIMORPHISM IN STAMENS OF CROTOLARIA JUNCEA

In the course of our studies on anthesis of crop plants, an interesting type of dimorphism in stamens was observed in *Crotalaria juncea*.

The inflorescence is a raceme with the number of flowers ranging from 14 to 22 with an average of 16. The number of days taken from the bud initiation to flower opening is on an average 20. The flower remains open for a day. The flower is typically papilionaceous, the only interesting feature being the dimorphic stamens. The androecium consists of 10 stamens, 5 of which have round anthers and 5 linear anthers, arranged alternately on a ring.

TABLE I
Lengths of the dimorphic stamens during the development of the flower-bud in *Crotalaria juncea*

Developmental stages of flower-bud	Age in days	Length in cm. of the stamens		Difference in length of stamens of the two types	Remarks
		* Length in cm. with linear anthers	* Length in cm. with round anthers		
1	5	0.40	0.05	-0.35	
2	6	0.50	0.05	-0.45	
3	7	0.55	0.10	-0.45	
4	8	0.52	0.10	-0.45	
5	9	0.60	0.15	-0.45	
6	10	0.65	0.15	-0.50	
7	11	—	—	—	
8	12	0.80	0.14	-0.66	Growth rapid in stamens with linear anthers
9	13	0.80	0.20	-0.60	
10	14	0.87	0.30	-0.57	Equal growth rate
11	15	0.95	0.30	-0.55	
12	16	1.20	0.60	-0.60	
13	17	1.30	0.80	-0.50	Growth more rapid in stamens with round anthers
14	18	1.25	1.00	-0.25	
15	19	1.20	1.30	+0.10	
16	20	1.30	1.50	+0.20	
(Open flower)					

* The length is measured from the base of the staminal ring to the tip of the anthers. Each figure is an average of five observations.

During the growth of the bud, there is a differential growth of the filaments of the dimorphic stamens. At each of the sixteen stages of the development of the flower bud, the staminal bundle was dissected out of the flower and the length of the two types of stamens was measured. The growth in length of the two types of stamens at different stages of the development of the bud is given in the above table.

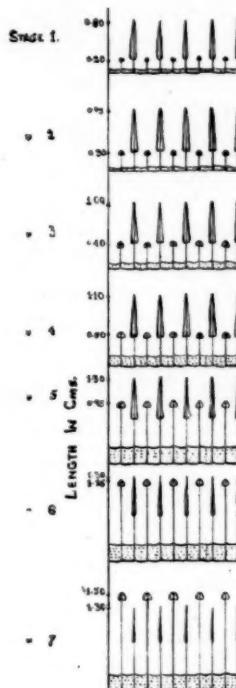


FIG. 1. Growth in length of the dimorphic stamens of *Crotalaria juncea* during flower bud development.

Fig. 1 represents the dimorphic stamens drawn to scale from seven representative stages in anthesis.

The measurements could be started only when the buds were 5 days old. At the first stage stamens with the linear anthers are 0.5 cm. in length while those with round anthers are 0.05 cm., the difference being 0.45 cm. Till the buds are 10 days old, the rate of growth of both types of stamens is the same as indicated by the constant difference of 0.45 cm. between the

lengths of the two. Between the 10th and the 12th day, the stamens with the linear anthers grow more rapidly, the difference between the two now being 0.66 cm. Between the 12th and 16th day the rate of growth in the two types of stamens is again equal as indicated by a constant difference between the two (Table I). Between the 16th and 20th day, there is a reversal in the growth rate of the two types of stamens—those with round anthers elongate very rapidly at the rate of 0.2 to 0.3 cm. per day while those with linear anthers do not increase in length at all (Table I). In the fully opened flower the stamens with round anthers are 0.2 cm. longer than those with the linear anthers (Table I, Fig. 1).

While the period of elongation of the stamens with linear anthers is up to the 16th day, that of the round anther bearing stamens extends over the whole period. The period of maximum elongation of the stamens with linear anthers is from the 10th to the 12th day while that of the other type is between the 16th and 20th day.

The linear anthers dehisce at the 12th stage while round anthers dehisce at the 16th stage

Howard, Howard and Khan¹ studied pollination in this plant and observed that cross-pollination takes place and that self-pollination is possible if the stigmatic surface is stimulated by insects or other means. Samal and Benerji² while studying the microsporogenesis in this plant have recorded dimorphism of stamens with respect to anther shape only. Our detailed study of anthesis has indicated that this dimorphism extends to the relative growth in the two types of stamens at different stages of development.

The bearing of this dimorphism in stamens on the pollination in this plant is being investigated.

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December 1, 1948.

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FEEDING METHODS OF THE COTTON WHITE-FLY

STUDIES on virus transmission by the white-fly (*Bemisia tabaci* Genn.) have shown that the insect is a vector of several virus diseases of plants prevailing in this Province. Some of these diseases are of the 'localised' type, such as the yellow vein-mosaic of *bhendi*,¹ while others are 'non-localised' like the yellow mosaic of *Phaseolus lunatus*.² Moreover, the white-fly requires much longer Feeding Time in order to secure virus from diseased plant than for transmitting it to a healthy one irrespective of the type of virus involved.³ These and similar other observations necessitated detailed investigation on the feeding methods of the adult white-fly in relation to the viruses it transmits. This note briefly deals with the preliminaries.

Hargreaves⁴ and Smith⁵ observed that the *Aleyrodes* larvæ feed mostly on the phloëm, although stylets were observed to be present in the paranchyma alone, specially in the case of very young larvæ.⁵ However, no information is available in literature as to the methods by which the adult white-fly penetrates and taps the host tissues for extracting food.

In order to fix the flies in their feeding position it was necessary to starve them for at least three hours before liberating them on the host plants. The host plants used were *Hibiscus esculentus* L., *Phaseolus lunatus* L., *P. vulgaris* L., and *Dolichos lablab* L. Insects were confined to individual leaves of the host plants and allowed varying Feeding Time, after which they were killed *in situ* with the help of a wad of cottonwool soaked in chloroform. Thereafter, the portion of the leaf with the insects on was cut into pieces of convenient size and fixed in formalin acetic acid alcohol fixative, sectioned 10- to 15-micron thick by the usual paraffin method,⁶ and stained either with Heidenhain's haematoxylin or Flemming's triple stains.

The fly as a habit settles down to feed on the underside of leaf and punctures the lower epidermis at any place (Figs. 1 and 2), but before doing so it deposits some salivary secretions on the spot to be pierced and also applies pressure on it with its rostrum in order perhaps to stretch the layer (Fig. 1). The stylets enter the leaf usually between two cells and take an intercellular course in the mesophyll (Figs. 1 and 2),

while an intracellular course in collenchyma and in the phloëm tissues. During the progress of the stylets into leaf tissues, the fly deposits along with its saliva a substance which sets into a hard gel forming a tubular sheath (Figs. 1 and 2).



FIG. 1. T.S. of leaf of *Hibiscus esculentus* with a salivary sheath, indicating the intercellular course of the stylet track in the mesophyll. Note depression and salivary deposits outside on the epidermis.

These sheaths stain deep red with Fleming's triple or deep blue with haematoxylin and form well marked stylet tracks in the leaf.

The ultimate objective of the flies is the pelém (Fig. 2) from which they suck their food. When the flies were allowed to feed for 15 or 30 minutes only, most of the salivary sheaths were found to be short and terminating abruptly in the mesophyll, occasionally going even as far as the palisade layer (Fig. 1). When, however, the insects were allowed longer Feeding Time, the salivary sheaths were long and curved or profusely branched, and in majority of the cases the stylets reached the phloëm. Also, more than one salivary sheaths were present close to each other indicating that the insect withdraws completely from the leaf after having fed on a particular cell and punctures again in the near vicinity, following almost the same course, in order perhaps to tap another

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sieve tube or cell. Since no visible injury is caused to the host plants by the feeding of white-flies, it is evident that the insect saliva is non-toxic to plant tissues.

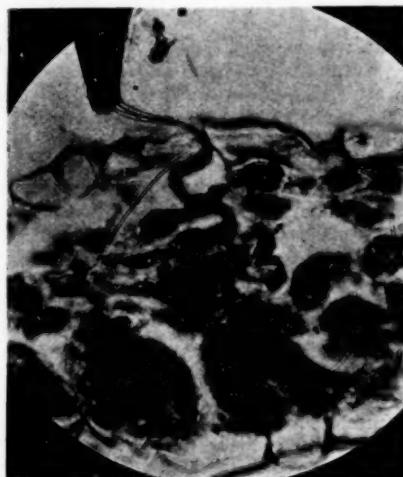


FIG. 2. T. S. of leaf of *Phaseolus lunatus* showing the stylets and the stylet track. The position of the salivary sheath in leaf indicates that the insect had been feeding upon the phloem.

This work is being carried out under a scheme financed by the Indian Council of Agricultural Research.

Plant Path. Laboratory, S. P. CAPOOR.
College of Agriculture,
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December 6, 1948.

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PRODUCTION OF OOSPORES BY *SCLEROSPORA SORGHII* ON MAIZE

WITH the exception of *Sclerospora macrospora* Sacc., no other definite species of *Sclerospora* with the non-sexual stage bearing conidia or sporangia on tree-like conidiophores, has so far been reported to form the oosporic stage on maize (*Zea mays* L.). In February 1940, the writer observed some maize plants, variety Kashmir Sweet, which were quite stunted and etiolated. An examination of the leaves indicated that

the plants had been attacked by a species of *Sclerospora*. Other varieties of maize, even though they were affected by the same disease, did not show the formation of oospores.

Comparative studies of conidia, oospores, etc., have indicated that this *Sclerospora* is identical, with regard to shape and size, with *Sclerospora sorghi* (Kulkarni) Weston and Uppal. Cross-inoculation tests have further shown that *Sclerospora sorghi* from Jowar (*Sorghum vulgare*) can infect the Kashmir Sweet variety of maize and vice versa.

As the position of *Sclerospora macrospora* whose non-sexual stage does not involve tree-like conidiophores but unusual single, large Phytophthora-like sporangia borne singly on stalk, in the genus *Sclerospora* is doubtful, this perhaps is the first report of the discovery of the oosporic stage on maize.

A detailed report will soon be published.
Plant Path. Laboratory,
College of Agriculture,
Poona,
January 15, 1949.

M. K. PATEL.

DOLICHOS BIFLORUS L.—A NEW HOST OF *XANTHOMONAS PHASEOLI* *SOJENSE* (HEDGES) DOWSON

SOYBEAN cultivation in this Province is at present of minor importance. On the other hand, *Kulthi* (*D. biflorus*) is cultivated quite commonly as a pulse and fodder crop either mixed with Jowar and Bajri or alone on light soils during the kharif season. A bacterial leaf-spot on *kulthi* was found on the Government Farm, Nipani in Belgaum district in August 1948. The disease resembled that on soybean so much so that the pathogene was isolated and studied in detail.

On the *kulthi* leaves, the pathogene produces numerous minute specks which coalesce forming lesions which measure 1 to 2 mm. The spots are raised, rough to touch mainly due to dried bacterial exudations and are found on both sides of the leaves with a light brown border around such spots. The pathogene was found to infect leaf-petioles also. The bacterium isolated from *kulthi* leaves was sprayed on 2 varieties of this host, viz., one with black seeds from Nipani and the other from Poona with brown seeds. The black-seeded Nipani variety looked very much like the soybean

plants in its seedling stage that it was considered advisable to inoculate soybean plants with the *kulthi* culture. Both the hosts showed characteristic symptoms of the disease in 10 days. *X. phaseoli sojense* was then sprayed on the leaves of soybean and *kulthi* when it was found to produce the characteristic symptoms.

Since the *kulthi* organism resembles *X. phaseoli sojense* in morphological, cultural and physiological characters and since both these pathogens are cross-inoculable, it is considered that *D. biflorus* is a new host of *X. phaseoli sojense* hitherto unreported.

Plant Path. Laboratory,
College of Agriculture,
Poona,
January 15, 1949.

M. K. PATEL.
Y. S. KULKARNI.
G. W. DHANDE.

A REMARKABLE ABNORMALITY IN THE DEVELOPMENT OF VIVIPARUS DISSIMILIS (MULLER)

DRUMMOND¹ observed a few abnormalities in the development of *Paludina* (= *Viviparus*), and MATTOX² has described the abnormalities in the intra-uterine young ones of *Campeloma*. Apart from these observa-

mality in *Viviparus dissimilis*, which is represented in the accompanying illustrations. The embryo, which was living and actively swimming in the albumen in the egg, belongs to an advanced stage of development. The head and foot are normal. The tentacles, the eyes, the buccal mass, the radula, the salivary glands, the opercular area of the foot and the ctenidium have all attained the definitive organization. But the visceral hump is very peculiar. It has bulged posteriorly and dorsally, and is roughly thimble-shaped with a ventral flexure, but without spiral coiling or lateral torsion. The neck of tissue between the visceral mass and the rest of the body is much elongated as compared with the normal condition, and not twisted. Other noteworthy features relating to the abnormality of the visceral mass are the complete absence of a shell and the non-differentiation of the digestive gland.

But the most striking features relate to the mantle cavity, and especially the ctenidium. The mantle cavity is but little developed, being in the form of shallow and open cavity without a roof, and situated at the hind end of the embryo. It is better developed on the left side. The

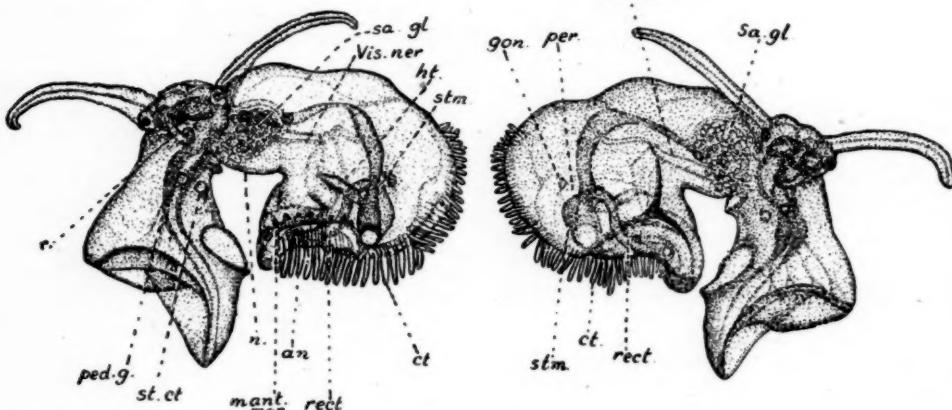


FIG. 1. Abnormal embryo of *Viviparus dissimilis*, viewed from the left side

an., anus; ct., ctenidium; gon., gonadal rudiment; ht., heart; mant. mar., mantle margin; n., neck; ped. g., pedal ganglion; per., pericardium; r., radular sac; rect., rectum; sa. gl., salivary gland; st. m., stomach; st. ct., statocyst; visc. ner., visceral nerve.

tions, no detailed studies of abnormal Gastropod development have been made. Recently I came across a remarkable abnor-

FIG. 2. Abnormal embryo of *Viviparus dissimilis*, viewed from the right side

ctenidium however is well developed, much elongated and composed of about forty filaments. But its position is abnormal, as

it extends on the outer surface of the visceral hump from the rudimentary mantle-edge right up to the apex. Alongside of the ctenidium is a low ridge which probably represents the aborted continuation of the mantle fold. The position of the ctenidium in relation to the rectum is also noteworthy, since it is found to the left of the rectum and would have become the topographically right ctenidium if torsion had taken place and the mantle cavity shifted to the anterior end, whereas in the typical streptoneurous Gastropod the definitive ctenidium is the primitive right but topographically left ctenidium. The other pallial organs also have consequently changed their position in relation to the rectum in the present case, which may be considered therefore as an instance of *situs inversus*.

The posterior position of the mantle cavity admits of an explanation in terms of differential growth, but the position of the ctenidium on the outer side of the visceral hump is very puzzling. There is no evidence of the mantle having turned inside out (by a process analogous to that of an extrogastrula). Probably the ctenidial rudiment has developed precociously and grown rapidly along with the visceral hump, while the mantle fold has remained in an abortive condition, spread out and continued as a low ridge alongside of the ctenidium, so that the mantle cavity is shallow and without a roof.

It may not be incorrect to attribute the abnormalities partly to the non-development of the shell gland, for the development of the mantle fold and mantle groove is related in space and time to that of the shell gland. But to account for the suppression of the shell gland is not easy. I have been trying to induce experimentally this type of abnormality in the laboratory, but have not been successful so far. If we could understand the causal factors of abnormal development, some of the problems of Gastropod development like torsion would be better explained than at present.

Zoology Laboratory, R. V. SESAIYA,
Annamalai University,
Annamalainagar,
February 4, 1949.

1. Drummond, J. M., *Quart. J. micro. Sci.*, 1902, 46. 2. Mattox, N. T., *Am. Mid. Nat.*, 1936, 16.

CARPET BEETLE DAMAGE TO TELEPHONE WIRES

THE carpet beetle (*Anthrenus* sp., *Dermestidae, Coleoptera*), is commonly met with in different parts of India, damaging woollen fabrics. On account of the large tufts of hair on the grubs and pupae, the insect is popularly called the 'woolly bear'. The damage is caused mostly by the grub, which bites the woven fabric causing holes and ultimately converting the same into a mass of cut threads.

The insect shuns light and invariably feeds on that surface of the fabric which is against light and thus avoids easy detection.

In February 1948, the Telephone Exchange, Bangalore, reported serious damage to the insulation of the telephone wires of the machinery. On examination large numbers of this insect in various stages of development were found infesting the material; the insect was probably breeding in the medium for some time prior to February. Availability of plenty of food material and the well-closed rooms were very well suited for the optimum activity and rapid multiplication.

Thousands of grubs had scraped and bitten the insulation material, exposing the wire and harboured themselves in the several crevices thus created. As a consequence, it was reported that there was short circuit.

A dust containing a mixture of 4 parts of D.D.T. spray powder (Geigy), 4 parts of Pyrethrum and 1 part of Gammexane D 025 (I.C.I.) was used against the insect. The worst affected columns of machinery were completely covered with tarpaulin and then the dust applied liberally. About 2 hours after dusting most of the grubs and adults were found to be disturbed from their resting places and few were found in a moribund condition. As a small number of grubs were found alive even after 96 hours it was found necessary to give a second dusting. Sufficient time was allowed for the egg, if any, to hatch out and a second dusting was done allowing an interval of three weeks between the two dustings.

I am grateful to Sri. B. Krishnamurti, Government Entomologist, for advice.
Entomological Lab., M. APPANNA.
Agri. College and Res. Inst.,
Bangalore,
March 7, 1949.

REVIEWS

Waste Heat Recovery from Industrial Furnaces. A Symposium. (Published by Chapman & Hall Ltd., London). 1948. Pp. x + 383. Price 35sh. nett.

This is an important publication of great practical value. The contributors to this Symposium conducted by the Institute of Fuel, London, are eminent authorities in different branches of the subject handled by them. The chief aim of everyone of the authors has been the application of available scientific data in a most practical manner to introduce the latest methods of waste heat recovery and derive financial benefit.

The Institute of Fuel is one of the most important technical organisations in England and national in its outlook. The present publication is educative and propagandistic in the methods of its approach and appeal. It is mainly addressed to British industrialists. Mr. G. N. Critchley says: "It therefore becomes a matter of great importance to study the means whereby the limited amount of fuel available may be made to produce the greatest output of goods, not only for home requirements but also to supply export markets on a far greater scale than ever before." The manner and method of achieving this, are elaborated by the contributors in a most scientific and practical manner in the body of the book. All those who are engaged in industries that use large quantities of coal or gas should feel grateful to the authors.

It is necessary to keep in mind that this publication confines itself only to the subject of the recovery of heat from waste gases from industrial furnaces,—nothing more or nothing less. It does not deal with the whole subject of fuel economy which forms the subject of matter of a masterly treatise entitled "Efficient use of Fuel" published three or four years ago by H.M.G. Stationery Office, London. As a matter of fact a general study of this treatise as well as a study of the book entitled "Industrial Furnaces" published by Messrs. John Wiley and Sons will form a helpful and useful background for fully appreciating the recovery of waste heat from industrial furnaces.

According to the temperature required in industrial heating operations, the flue gases must leave at a more or less elevated temperature which will obviously be above the temperature to which materials are heated in the

furnace. Part of the sensible heat of these gases will be required to create the necessary draught if a chimney is used for this purpose. If a fan is used for creating the draught the outlet temperature can be very much lower. The gap (or difference) between the outlet temperature of the furnace and the minimum permissible temperature of discharge represents heat which could be saved. This, in essence, is what is popularly known as waste heat recovery from industrial furnaces.

For purposes of waste heat recovery, recuperators or regenerators are in use. Recuperators consist broadly of systems of flues, some of which carry in-going air, and others outgoing flue gases at a higher temperature, so arranged that there can be heat interchange between the air and gas. On the other hand, a regenerator is simply a heat exchanger constructed of refractory material. In its simplest form it comprises two chambers filled with chequer firebricks, the bricks being so stacked that gases can flow freely between them and around them. The waste heat from industrial furnaces has in very many instances been utilised for the raising of steam in specially designed waste heat boilers.

The first two chapters of the book under review furnish all the scientific data on the theoretical side of the problem. Then follows special experiments conducted on pilot plant scale on the engineering side of the problem to determine the factors governing the design of regenerators (with special reference to coke ovens) and tubular metallic recuperators and waste heat boilers. The remaining chapters have the problems of special industries like carbonising industries, metallurgical industries and the glass container industry considered in great detail with a view to introduce economies in working by the recovery of waste heat. Closely connected with waste heat recovery are problems of refractories and insulations. Adequate treatment has been given to these two subjects. The savings that can be effected in the annual consumption of coal and the labour employed and the consequential cash gain by adoption of waste heat recovery methods in a scientific manner by some extra capital equipments have been analysed and the results given in Tables I and II. These two tables merit very close study and will convince any industrialist about the wisdom of installing waste heat recovery equipment as soon as possible.

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Taking into consideration such an ordinary and routinish thing as proper insulation, it is amazing to read in Tables I & II that by proper insulation applied to the roof of a glass melting furnace at a cost of £210 and on the basis of working the furnace for 8,000 hours in a year, 940 tons of coal can be saved per annum which would cost £1,880. If the insulation would last for five years, the annual return on the investment would amount to 895% and during the five-year period of the insulation's life, the total return on the capital invested would be 4,475%. This is not all. The labour required to mine 940 tons of coal per annum or 4,720 tons during the five year period of insulation's life is a national gain, since this labour can be employed to produce more coal or be employed in other gainful occupations.

The book is recommended for study by every student of fuel technology. It more than repays the time required for it. The price of the book is somewhat on higher side.

So far as conditions obtain in India, the biggest users of coal for industrial purposes happen to be the Tata Iron & Steel Co., and the Indian Iron & Steel Co. Reports indicate that they both seem to be alive to this problem and a lot has been done in this direction. They seem to be up-to-date on this subject but still, —one never knows—a study of this book may reveal places where the waste heat recovery has been neglected and may be adopted in future. So far as the cement industry in India is concerned, it is a matter of regret that the industry as a whole has not looked into this problem at all. It is a great pity. One hopes that just as the British Government did during the war time and subsequently, our own Government would carry on propaganda to educate the sponsors of the cement industry about the waste heat recovery problems. So far as the glass industry is concerned, enterprising firms like Messrs. Ogale Glass Works, seem to be alive to this problem and they have recuperative or regenerative devices in connection with their tank furnaces. The methods employed in the glass bangle industry, since they are produced on a comparatively small scale, do not seem to admit of these modern methods of heat recovery but it is hoped that the new Institute of Glass Technology started as one of the National institutions will devote its closest attention to design improved furnaces even for the bangle industry to save fuel. In connection with the contact sulphuric acid manufacture at Tata Iron and Steel Works and also at Belagula at the Mysore Chemicals & Ferti-

lisers Factory, waste heat boilers have been employed. There have been some sporadic attempts at the Mysore Iron & Steel Works to use the flue gases from wood carbonisation retorts to pre-dry the incoming wood. On the whole, Indian industrialists do not seem to have been seized of the importance of this problem and the sooner they did the better it will be. The new All-India Institute of Fuel Technology that will be started at Dhanbad will have to undertake this work in a systematic manner and introduce all the latest methods of waste heat recovery by insisting on this, by legislation if necessary.

The importance of this problem to a country like England can be gathered by a quotation from the Foreword to the book by Mr. E. W. Smith. "It has been authoritatively stated that not more than 15—20% of the energy of our coal supplies is usefully employed... Even an additional 5% improvement would mean the savings in coal mined of between fifty to seventy million tons a year....!" The entire output of coal in India, roughly about thirty million tons a year, is only half of what Mr. E. W. Smith hopes to gain by introducing rational methods of waste heat recovery in England! Therefore, all those in India concerned with the future of industrial development should wake up and lose no time in tackling the problem in India in the most up-to-date manner.

Without in any way trying to detract from the exceptional merits of the publication, the reviewer may be permitted to notice the very first sentence by Mr. G. N. Critchley in his introduction to the book: "At the present time (June 1946) it appears likely that for at least some years ahead supplies of coal mined in Great Britain will be insufficient to meet full industrial requirements. There is thus a probability that fuel will, unless it prove economically practicable to import large quantities from abroad, be a major factor restricting national prosperity." It almost looks humorous that England, even as a distant possibility, thinks of importing coal from abroad. England has always prided herself on her coal deposits and time and again prominent people have made public statements, with a sense of pride to which they are entitled to. One prominent man stated:—"Civilisation is economy of power and our natural power is coal". Another leader stated: "It is cheapness and abundance of coal which has made us (British Empire) what we are." In fact, Great Britain has been one of the chief

countries for exporting coal in exchange for raw materials and foodstuff. Even now, the present Labour Government is fully determined to maintain the export of coal to other countries of the World and to afford bunkering facilities to steamships. And England is not likely to lightly change this attitude. The question then arises, "Why should England envisage a time when she may have to import coal from abroad?" It can only mean that she would like to have a tight hold on her export markets in order to maintain her national economy in other directions and if and when necessary also to import coal from other countries. In connection with the Organisation for European Economic Co-operation (O.E.E.C.), two white papers have been presented to the Parliament by Sir Stafford Cripps recently. It is mentioned therein that the coal exports which have been always a great asset in the Nation's economy have now assumed even greater importance as they can directly reduce the dollar expenditure of other European countries. With this thing in view, Sir Stafford Cripps suggests a target of 40 million tons for exports and bunkers from a total output (including open-cast) of between 250 to 260 million tons of coal mined in England. It only means that she does not want to lose even a single market. If necessary, she may import coal for her own needs and export her own coal abroad and thus continue her dominant position in a field in which she has been all too powerful all these years. There is nothing wrong in this and we wish them well.

Finally it is to be hoped that the Institute of Fuel, London, will publish other studies in the economy and use of fuel as soon as possible. Our thanks are due to this Institute for giving the world public this valuable publication.

S. G. SASTRY.

British Chemical Nomenclature. A. D. Mitchell. (Edward Arnold & Co.), 1948. Pp. 156+iv. Price 21/- net.

It is sad to contemplate that chemistry still lacks what Foster in the middle of the last century described as "the legal language of the science—a language whose terms are, as far as possible, strictly defined and have an exact and generally recognised value". Several attempts to standardise chemical nomenclature through international conferences have borne fruit only to a limited extent, partly because of the desire on the part of the national societies not to deviate from their established usage, and partly because of the

failure of these conferences, meeting at rear intervals, to keep pace with the rapid advances made in the meantime. In the absence of a universal system of nomenclature, the various publishing societies have adopted the only possible alternative, viz., that of framing a set of rules for their own guidance. Thus have arisen three main systems, viz., the British, the American and the Continental or German systems, each with its own established rules of nomenclature and enumeration which are often quite arbitrary and in many instances entirely different from those of the other two. No systematic attempt appears so far to have been made to present any of these systems in a consolidated form, although it must be admitted that the problem has been studied comparatively more fully in America than elsewhere, the compilation of the Ring Index by the American Chemical Society being justly regarded as a most valuable contribution.

The present volume embodying the conventions adopted in the *Journal of the Chemical Society* is therefore to be welcomed. The lucid lecture on British Chemical Nomenclature delivered by the late Dr. Clarence Smith in 1936 has been the only authoritative account recorded so far of this system, but the subsequent additions and amendments to the principles enunciated in it have often been hidden away in the footnotes of the *Journal*. With over twenty years of association with the *Journal*, the author of the book under review is eminently fitted to accomplish the task which he has set out to perform, viz., to prescribe general principles and their application to a variety of individual cases. The very nature of the contents of the book which are, in the main, a collection of rules of nomenclature and enumeration of both inorganic and organic compounds, prevents their detailed examination here. The journals in India tend to allow a good deal of freedom to authors in the choice of the system of nomenclature, but it is desirable that at least each journal adheres strictly to one definite system of nomenclature. Chemists using the British system will find this monograph to be of great service. The author has rightly drawn the attention of his readers, wherever necessary, to the gaps and inconsistencies in the present usage. The flexibility of the rules and the freedom that is often allowed to individual authors naturally result in inconsistencies which reach bewildering proportions in the case of complex fused ring systems.

On the need for a radical reform of the existing systems and for the adoption of a

universal system there can be no two opinions. But "national bodies never seem to realise that if any uniformity is ever to be attained and chaos avoided, concessions must be made." The new system of notation and enumeration of organic compounds proposed by G. M. Dyson in his book ("A New Notation & Enumeration System for Organic Compounds", Longmans, Green & Co., 1946) with its simple and invariant set of rules resulting in unique linear ciphers for the compounds which could be handled mechanically by a system of punched cards for the purposes of indexing, literature survey, etc., has much to recommend itself for universal adoption. But, in spite of the general desire to do away with trivial names in chemical literature, it is doubtful if even this system can succeed in doing so, since the ciphers share with the graphic formulae one of the inherent drawbacks of the latter, viz., the lack of a facile speech equivalent.

The get-up of the book is excellent and the index is comprehensive.

B. B. DEY.

Research in Industry. (Published for D.S.I.R. and the Board of Trade by His Majesty's Stationery Office, London. Price 1s. 6d.)

The articles published in the volume cover a variety of industries, i.e., cotton, wool, rayon, glass, pottery, iron and steel, lace, linen, boots and shoes, paint, furniture, plastics, light engineering and electrical consumer goods. In addition there are articles on electronics, machine tools, industrial design and radar.

The emphasis in each case is laid on the value of research for the future, both immediate and more distant, but examples of what research has already done for the industry are also given.

The article on wool for instance, describes research work done on carding which proved that lines of development employing higher speeds and fewer parts were practicable, contrary to previous accepted opinion. It was then possible to specify an 'ideal' card and to demonstrate this to firms and their carding engineers. With this machine a great increase in production can be obtained. Further, it was possible to achieve most of the advantages of the 'ideal' card by modifying the existing cards, without waiting for new ones.

A more spectacular example of the impact of science on industry has been the steady replacement in the potteries of the old type of coal-fired bottle oven by the modern tunnel oven. The advantages of this are that the

labour involved in firing ware is reduced, the work is made more pleasant, the firing cost is lowered, the quality of the actual ware is improved, and the thermal efficiency of the oven is increased. The kilns are fired by smokeless fuel, which will decrease the heavy pall of smoke which, up to now, has been an unpleasant feature of the pottery areas.

The article on electronics gives some details of what these devices are able to do for manufacturers. They can control machine tools, detect internal flaws and faults in metals, match colours, count and inspect finished products for size, surface finish, and weight. Almost any property of a product can be measured. There is wide scope for these devices in the protection worked from guillotines, presses, millers and so on. The application of the electronics to industry is practically limitless.

One of the industries which might be described as the child of research is plastics. Some of the uses of the 'silicones' are described in the article by Mr. N. J. L. Megson. In the baking industry, for example, silicones can replace fat for greasing baking tins. One application of silicone resin permits the baking of very many batches of loaves, whereas with fat the tins have to be greased after every batch. Only ten years ago silicones were regarded as laboratory curiosities having no commercial possibilities!

The potentialities of research applied to industry are well illustrated in the section on machine tools. Investigations carried out recently on drilling showed that the overall economic efficiency can be greatly increased by applying the results obtained. Moreover, these investigations and others showed that a few hundred pounds spent on this type of small tool research will save or yield as many thousands of pounds each year in a single factory if properly applied.

The necessity of following up research results at once is stressed in a foreword by Sir E. Appleton. As an example, he mentions the publication of a report on the fire proofing of fabrics for which the Stationery Office received a considerable number of orders from the U.S.A. within a few days of publication.

Organic Reactions: Vol. IV. Edited by Roger Adams. (Wiley & Sons, Inc., New York; Chapman & Hall, London), 1948. Pp. 428. Price \$ 6.00.

The fourth volume of the series of extremely valuable reviews of important synthetic organic

chemical reactions maintains the high standard of the first volume which appeared in 1942. As in the previous volumes each chapter is written by a specialist and provides a comprehensive survey of a reaction, which includes a general discussion of its nature and mechanism, its scope and limitations, and a detailed description of experimental procedure for the synthesis of typical compounds by the use of the reaction. Tables of the various compounds synthesised by or subjected to the reaction under review, pertinent experimental conditions including the yields obtained, and numerous references to the literature are, as in the earlier volumes, notable features of the book.

The Diels-Alder reaction, discussed in Chapters 1 and 2, is of outstanding importance on account of its versatility and the light it has thrown on the mechanism of polymerisation. The various types of compounds which can serve as dienes and as dienophiles are tabulated and the vast literature on the constitution of the adducts with maleic anhydride (in Chapter 1) and with ethylenic and acetylenic compounds (in Chapter 2) is ably summarised. With the commercial production of dienes such as butadiene, furan and their derivatives, and considering the wide variety of compounds which can serve as dienophiles, this review should stimulate the synthesis of hitherto unknown and inaccessible compounds by new applications of the Diels-Alder reaction.

The synthesis of aliphatic and aromatic amines by reductive alkylation (the introduction of alkyl groups into ammonia or a primary amine or secondary amine by means of an aldehyde or ketone in the presence of a reducing agent) is described in Chapter 3. By a suitable choice of conditions high yields of amines with the desired degree of alkylation can be achieved by this one step synthesis.

Methods for the synthesis of α -hydroxyketones of the general formula $R\text{-CHOH-CO-R}'$, known as acyloins if R and R' are aliphatic residues and as benzoins if these are aryl residues, are discussed in Chapters 4 and 5. The synthesis of benzo-quinones by oxidation, discussed in Chapter 6, is also of value for the preparation of quinones from naphthalene and higher polycyclic hydrocarbons, as well as heterocyclic compounds. The selective hydrogenation of an acid chloride to the corresponding aldehyde in presence of a suitable catalyst, usually supported palladium, is discussed in Chapter 7; the Rosenmund reduction is probably the best method for converting acids to the corresponding aldehydes and has wide

applicability. The Wolff-Kishner reduction of a carbonyl to a methylene group by heating the semicarbazone, the hydrazone or the azine in the presence of an alkaline catalyst, described in the last chapter, is a valuable alternative for the more common Clemmensen reduction, and is to be preferred to the latter in the case of the compounds of the pyrrole and furan series which are sensitive to acids; compounds of high molecular weight are not amenable to reduction by the Clemmensen method, but the Wolff-Kishner reaction is applicable.

K. V.

Theory of Groups and Its Application to Physical Problems. By S. Bhagavantam and T. Venkatarayudu. (Andhra University, Waltair), 1948. Pp. xii+234. Price Rs. 20.

As Physics extends its frontiers further and further, various new types of Mathematics are pressed into service and every succeeding generation of physicists has to master more and more of these mathematical disciplines almost always under protest as History shows. There was a time when the infinitesimal calculus itself was thought of as a difficult subject, to be introduced only into advanced treatises and even then with an apology. British authors fought shy of Vector Analysis in the same way and even now it is sparingly used in English books. The Theory of Relativity made it necessary for physicists to master Tensor Analysis, and again we see it being slowly introduced into text-books, often in a disguised garb. And now we have Group Theory, against learning which even Dirac is reported to have protested. One regrettable result has been that we no longer have physicists like Lord Rayleigh who are familiar with both the theoretical and experimental branches of physics. The experimenter has to take the theorist on trust, while very often the theorist does not know and does not want to know what his symbols mean. But time has shown that learning a new type of mathematics will in general become inevitable as physics advances. It will be more graceful and less painful if the acquisition is not unduly put off.

We may congratulate the authors of the book before us for showing that Indians are not slow to learn and employ even such an arduous discipline as Group Theory. Another reason for our congratulation is that while most of the scientific books produced in India are cram-books and notes, this is a high class production resulting from original study and investigation. The book is further noteworthy

as to the large number of different problems treated, and so, whether we learn Group Theory or not, we can turn to the book for various useful results. We have here the results of the application of Group Theory to vibrations of molecules and lattices, atomic and molecular spectra, Raman Effect, Nuclear Spin, Crystal Optics, Optical Activity, Elasticity, Photo-elasticity, Piezo-electricity and Electrical Double Refraction. This list of applications should certainly convince even the most sceptical that learning Group Theory is worth while. It is also not an exaggeration to say that the book shows a collection of useful information not easily to be found anywhere else within two covers.

While the copiousness of the information is one of the merits of the book, it is also the source of its chief weakness which is undue compression. Almost every sentence is a theorem or an important part of a proof, and the sentences run into paragraphs without halts, so that anyone who does know something of the subject will be bewildered. The equations are not numbered, and when references are made to previous treatment in the book, one does not know where to turn and has to search, sometimes at random. Figures are all too scarce and this adds to the difficulty of following the text. As an example of this, it will be seen that "Symmetry Operations and Point Groups" treated in twelve pages of small type with three pages full of figures in Herzberg's "Infra-red and Raman Spectra of Polyatomic Molecules," are here compressed into less than four pages of open printing with no figures. (The figures given in Chapter II are artistic, but not of much practical use.) In the same way most of the information given in Wigner's Gruppen-theorie from p. 63 to p. 78 is here condensed into pages 18-24. Chapter V of the book condenses almost half of the information in any book on Wave Mechanics (e.g., Pauling & Wilson's book) into 11 pages. One has to learn all about matrices as used in the book from three pages in Chapter IV. If only the authors had allowed themselves more space and arranged the matter in a more arresting way so as to make the chief results stand forth, the value of the book would have been enhanced to an appreciable extent.

The arrangement of the material does not show a logical plan; we oscillate from groups to lattices and jump to atomic spectra and back to groups. Some important parts of the theory are to be found thrust into appendices. The discussion of the relative merits of the theories

of Raman and Born is useful but does not seem to lead to any definite judgment, and occupies much space in the middle of the book. The attempt seems to have been to indicate as many applications of Group Theory as possible at any point that offered itself in the development of the book.

Misprints are really few. We have noticed minor ones on pages 44, 46, 97, 101, 127, 161 and 203. On pages 36 dV in $\int \psi_1^* \psi_2 dV$ is said to be an element of 'phase space'. In Fig. 15 the letter O is not present.

References to other books and original papers are not given except a general list at the end of the Preface. It is therefore difficult to find the original contribution of the authors of the book, although there are indications to show that a good deal is original. We only wish that the condition of inflation and paper shortage evidenced by the price and the compression were soon removed so that the authors felt free to discuss the material at their leisure and provide it with the illustrations so necessary to understand the subject. The book would then be an even more valuable acquisition to a Physics Library. Even as it is, it is an essential and valuable contribution to the literature of Physics.

T. S. S.

The Basis of Chemotherapy. By Thomas S. Work and Elizabeth Work. (Oliver & Boyd Ltd., London), 1948. Pp. xx + 435. Price 26/- net.

The development of knowledge in the branch of chemotherapy has been so rapid during the past few years and the field covered by this development so varied that it is difficult for any individual to keep in touch with the progress in branches of science outside his speciality. Consequently when those who have spent some time in the study of this important subject are willing to co-ordinate their knowledge and present it in a concise and readable form they perform a service of great value. Work and Work have served two distinct purposes in writing this volume. Firstly, they have presented the knowledge available upon the chosen topic in a form intelligible to those whose activities may be along a wholly different line. Many chemists fail to realise how closely their investigations may be connected with other work which on the surface appears far afield from their own. This book enables us to form closer contact with works on the allied lines of research. The second purpose is to promote research in

the branch of science covered by the book by furnishing a well-digested survey of the progress already made and by pointing out directions in which investigation needs be made. To facilitate the attainment of this purpose enough references have been given so that any one interested can readily find access to the literature. The specialist does not need exhaustive bibliographic treatment, as he is already familiar with the material in his field. A critical selection has, therefore, been made on those papers which are important.

The reader is assumed to have a knowledge of the background of biochemistry, organic chemistry and microbiology. For the sake of continuity and brevity many aspects of chemotherapy are only mentioned. It is hoped, nevertheless, that this description will make available to the workers in this line the trends and meaning of a field in which much difficulty is caused by a great mass of conflicting data. A critical evaluation requires so much elaboration that the authors make no pretense to be exhaustive. They have tried to build up a composite picture of intermediary metabolism of living cells, particularly bacterial cells as shown by their nutrition requirements. A study in this direction may help in elucidating the mode of action of known chemotherapeutic drugs and in developing new ones. The authors have dealt with kinetics of enzymic reaction and the subject of enzyme inhibition, so that the reader is able to distinguish between various types of inhibition known to occur. Since enzyme inhibition is often a reversible process, it is often found that the growth inhibiting action of drugs on living cells can frequently be removed by the addition to the drug-cell-system of what is known as 'antagonists'. In the chapter on drug antagonism the authors have elaborately dealt with this factor which can bring about removal of drug from its site of action. A study of antagonism leads us also to the field of drug resistance. Drug resistance is a tool for the study of acquired character, inheritance, differentiation and the relation of gene to environment. The authors have to be congratulated for trying to explain these points very lucidly.

The underlying pattern of the book is a carefully prepared and informative historical survey of the topic, an interpretation of the present and latest development in the field and an indication of some of the unsolved problems still confronting the chemotherapists. The book is highly recommended to those engaged in the field of research in chemotherapy.

N. N. DE.

The Chemistry and Manufacture of Indian Dairy Products. By K. S. Rangappa and K. T. Achaya. (The Bangalore Printing & Publishing Co., Ltd., Bangalore-2). 1948. Pp. xi+189. Price Rs. 10.

The book contains a useful collection of data on Indian milk and milk products. Though several standard text-books on the technology and chemistry of milk and its products are available, these invariably include only the data obtained under conditions widely differing from those prevailing here. During recent years, a considerable amount of published literature on Indian dairy products has accumulated which is widely scattered and not always easily accessible. The authors have done a great service in bringing all these data together.

The book is divided into three broad divisions covering 14 chapters, and is supplemented by author and subject indexes. The methods of preparation of important dairy products are described. In a vast country like India various modifications are followed for preparing the same product, but the outlines given help to convey a fairly general picture. The composition and characteristics of Indian milk products are described in detail. Side by side, these data have been compared with the results obtained by workers in other countries. This helps to bring out clearly the outstanding points between the two. References up to the year 1948 have been included mainly from the authors' own work, but a few omissions are noticeable. At some points matter irrelevant to the subject of the book has been allowed to creep in, and the data for the composition of some of the less well-known products are not quite up to date. But apart from these few corrections of a minor nature, the authors have accomplished a difficult task with credit, considering the fact that this is the first time that such a publication has been compiled. The book fulfils a long felt gap and is sure to be widely appreciated by specialists and students. The printing and illustrations have been done clearly, and the book has a very attractive get-up.

NOSHIR N. DASTUR.

The Indian Association for the Cultivation of Science-Annual Report, 1947-48.

The first part of the report contains a brief review of the development plan, research personnel and other matters, the resumé of the scientific work done in the Association being given as an Appendix. The development plan seeks to create five new departments, viz., of

General Physics (Optics), Theoretical Physics, Organic Chemistry, Inorganic Chemistry and Physical Chemistry, as also to supplement the researches of the Department of X-Rays and Magnetism in the domain of Molecular Structures. The plan further contemplates that the researches carried out in the Association would be such as to find application in investigations of the physics and chemistry of High Polymers. Partial effect has already been given to the plan during the period under review by the appointment of two new Professors and providing each with a part of the approved research personnel.

The researches carried out in the Department of X-Rays and Magnetism under the M. H. L. Professor were mainly concerned with the studies of the extra-reflections in Laue photographs and their temperature variation, low angle scattering and structure analysis of phenanthrene crystals, radiographic study of coals, and X-ray studies of plastics, glass and fibres. The interesting work on the magnetic behaviour of dia- and para-magnetic substances especially in the form of single crystals has been continued. A systematic study of the magnetic and electrical properties of semiconductors has also been undertaken. In the year under report, nine papers have been published.

The work done in the Optics Department is mainly concerned with the Raman spectra of various compounds in different states of aggregation and at different temperatures. The Department of Physical Chemistry was in existence for a period of three months only. Research work on polymerisation, kinetics of halogenation of sodium acetate in glacial acetic acid, surface active agents, etc., has been started.

R. S. K.

Practical Zoological Illustrations: Invertebrates. By W. S. Bullough. 32 cards. (Macmillan & Co., London), 1948. 15s.

This set of semi-diagrammatic figures of typical invertebrates including *Branchiostoma* consists of 32 plates intended for the High School and first year University courses.

While the figures are useful as guides, the intermediate students of Indian Universities will feel the want of the sectional views of many of them. Particularly, *Lumbricus* is not of any use to them.

In *Nereis*, the head is not correctly drawn and also all the setæ are shown to be uniformly of the same type. The number of

bundles of Malpighian tubules, the gonapophyses and the correct delineation of the leg of *Blatta* are necessary.

In *Branchiostoma* (*Amphioxus*) the representation of gill slits and the nerve cord are not accurate.

It is hoped that the students who refer to these cards will make use of them as the author wishes them to be and not for copying them.

The printing of the cards is excellent. The price is unfortunately above the reach of the average Indian student.

L. S. R.

Bulletin of the World Health Organisation: Vol. I, No. 2. (Sales Section, Palais des nations, Geneva, Switzerland), 1948.

Report of the Expert Committee on (1) Tuberculosis, (2) Various Methods of Malaria Control, (3) Malaria Control in Egypt by Species-Eradication Method—*A gambiense*, (4) Cholera Epidemic in Egypt in 1947.

The Committee recommend organisational and control measures pertaining to various items under report. They recommend and give expert advice to countries which have not got proper Public Health Organization in order to combat major health problems such as malaria, tuberculosis, venereal diseases, which three diseases owing to their widespread prevalence, the Committee consider to be international rather than national or racial problems.

In the campaign against tuberculosis, the aim is to have a uniform standard in devising ameliorating measures, such as: (1) prevention, (2) case finding, (3) isolation and medical care, (4) social and economic protection of the afflicted. The salient features of the preventive method is training of technical personnel, expert advice, health education and propaganda to stimulate popular co-operation, besides (1) uniform procedure regarding research relating to preparation of tuberculin and tuberculin testing, (2) preparation and application of B.C.G. vaccine, (3) classification of tuberculosis, (4) x-ray interpretation of mass radiology, (5) evaluation of the new chemotherapeutic agents, etc. The Committee emphasises the importance of complete co-operation and co-ordination efforts on the part of the official and private agencies in order to obtain maximum results.

In the sphere of malaria prevention, the Committee gives first priority to mosquito control measures by drainage, application of D.D.T. and other suitable larvicides and insecticides. More research on these lines is needed. The Committee does not overrule the

importance of chemotherapy and chemoprophylaxis in the clinical control of epidemic malaria. Chemoprophylaxis however efficient is only considered a palliative measure. Therapy plays only a secondary role in the prevention of malaria. The Committee considers the importance of basic research on the following subjects, which should be encouraged in places where there are proper facilities, *viz.*, Rockefeller Foundation, Indian Research Fund Association, and British Colonial Research Committee:—

1. Parasite—Animal relationship ; 2. Vector and insecticides ; 3. Epidemiology ; 4. Chemotherapy and chemoprophylaxis.

Applied research on the following is also recommended :

1. Choice of control method ; 2. Insecticides ; 3. Organization and equipment.

The Bulletin will be found very instructive to all Public Health Workers and may be commended to be read in the original.

K. P. MENON.

Industrial Hygiene and Toxicology. In two volumes. Prepared by a group of Specialists under the Editorship of Frank A. Patty, Director, Industrial Hygiene Service, General Motors Corporation, Detroit, Mich. Vol. I. (Interscience Publishers, New York, London), 1948. Pp. xxvii+531.

Hazards associated with various occupations such as mining, smelting, etc., were known from ancient time and certain precautions were taken to minimise the dangers from inhaling metallic dust and fumes. The first organised effort was the result of the introduction of labour legislation of the 19th century in England to reform the deplorable conditions of the workers in English Cotton Mills. Further reforms took place from time to time. Even so they were of the nature of the periodical examination of workers and prescribe remedial measures; no attention was paid to improve environmental condition to prevent the occupational disease. Although there were many books published on the medical and legal aspects of occupational and industrial disabilities there are only a few books on industrial toxicology and still fewer on preventive engineering and control of occupational diseases. The present concept of industrial hygiene began to develop during the World War I as a result of ill-health and increased mortality among workers in munitions

factories. Organised efforts to impart instructions bearing industrial hygiene began by institution centres of study in American Universities, the first of which was established at Harvard Medical School where initially a Department of Applied Physiology was started. Other Institutions then began to spring up imparting instructions in industrial hygiene in collaboration with Doctors, Engineers and Chemists. Under the impact of World War II, industrial hygiene units were established in all the industrial States of U.S.A. Managements have realised the importance of improving the environmental conditions of the employees to ensure industrial efficiency and enhanced dividends. The present volume is a collective effort of various authors with thorough knowledge of the problems of efficient industrial conditions. The Editor is one who has to his credit vast experience in the field and is now the Director of Industrial Hygiene, General Motors Corporation, one of the largest single industrial organisations in the United States of America. The book is neatly got up and the textual matter is discussed in sufficient detail to afford an intelligent understanding of the various aspects of the subjects, which are classified as follows :—

1. Industrial Hygiene Retrospect and Prospect.
2. Industrial Hygiene Records and Reports.
3. Industrial Hygiene Survey and personnel.
4. Personal factors in competence and fatigue.
5. Environmental factors in fatigue and competence.
6. Physiological effects of abnormal atmospheric pressure.
7. Mode of entry and action of toxic material.
8. Sampling and analysis of atmospheric contaminants.
9. Radiant energy and Radium.
10. Ventilation.
11. Occupational dermatoses.
12. Visible marks of occupation and occupational diseases.
13. Fire and Explosive hazards of combustible, gases, etc.

The author stresses the need for the active collaboration of Engineers, Doctors, Chemists, Psychologists and Socialists all working together to achieve the common end of the well-being of the workers and efficient industrial output. The book will be a source of valuable information to those who are interested in industrial welfare and organisation.

It is hoped that Volume II on Toxicology will be equally useful.

K. P. MENON.

SCIENCE NOTES AND NEWS

Infra-Red Photography of Forests

The "magic eye" of the infra-red film, peering down from the cameras of the Royal Air Force photographic reconnaissance aircraft, is to probe the secrets of Scotland's forests. Marked "high priority" on the R.A.F. Central Photographic Establishment flying programme for 1949 is the project for infra-red photography of forests in the Strathyre-Loch Ard area.

The Survey is being undertaken for the Forestry Commission and it is expected that the use of infra-red photography from the air will enable the Commission to make a more exact classification of trees. At present it is possible to make a general classification from ordinary photographs sufficient to distinguish trees as either coniferous or deciduous. Infra-red photographs, however, are expected to show the state of growth of trees and to distinguish tree types within the coniferous or deciduous groups.

Some 200 square miles of forest have been selected as a testing ground for this experiment.

Need for Fundamental Research on Insects in India

In his Presidential Address delivered at the 11th Annual Meeting of the Entomological Society of India, held at Allahabad, on 4th January 1949, Dr. Hem Singh Pruthi stated that "On the whole India has not made many conspicuous contributions to the Science of Applied or Economic Entomology" principally because, "very little attention has been paid in India to fundamental work in Entomology, such as Insect ecology, physiology, morphology and taxonomy, on which alone good applied work can be based."

The Universities of India are the most suitable places for basic work, as in all other countries. In the laboratories of the Universities a great deal of work of an essentially basic nature on the problems of insect behaviour, genetics, heredity and evolution can be undertaken, besides morphology, physiology, ecology and taxonomy which will finally lead to proper and adequate application to economic problems in Entomology.

In the Indian Universities at present, the professors of zoology pay very little or no

attention to work on insects although in foreign universities teaching and research on insects occupy a place equal in importance to all other Science subjects. One of the reasons for this has obviously been that the heads of zoological departments are essentially zoologists with no special training in entomology and that suitable and competent entomologists are not recruited on to their staff; furthermore, trained Entomologists in India are extremely few.

The Department of Scientific and Industrial Research of the Government of India should consider seriously the establishment of a National Entomological Laboratory for work on basic aspects of the science of entomology. Such a laboratory with suitable and adequate staff could initiate all fundamental work on insects in close collaboration with the different universities and also train qualified men in entomology to serve as Readers in entomology in the Universities. The Indian Universities Commission should also make provision for teaching and research on insects in their Departments of Zoology.

Quarterly Bulletin of the Indian Standards Institution

The Indian Standards Institution has issued the first number of its Quarterly Journal, the *ISI Bulletin*. The Bulletin which is devoted to the publication of activities on standardisation in India and abroad caters to the needs of progressive industrialists, technologists, scientists and students in this field. In addition to the current news on Standardisation, the Bulletin publishes articles on technical subjects related to standardisation.

The first issue discusses the Standard Atmosphere for Testing in tropical and subtropical regions as distinct from the Standard Atmosphere in temperate regions. The advantages of adoption of this Standard Atmosphere in India are the simplicity of equipment, ease of operation and the comfort of the workers, which it answers.

A plea for Standardisation of Weights and Measures all over the country is made by Dr. Lal C. Verman, the Director of the ISI. He has also argued for the rationalisation, simplification and decimalisation of the fundamental units of length and mass, and

of the derived units of area, volume, etc., by introducing the decimal system, while retaining, as far as possible, the current terminology of Weights and Measures in India.

The progress of the Quality Control Movement in Industry, recently initiated by the ISI and the Indian Statistical Institute, forms the subject-matter of another article. Indian industry has begun to appreciate the need for adopting statistical methods of Quality Control in the manufacture of commodities. Courses have been established in Bombay for training technical personnel in the application of these methods. The ISI has reprinted the American Standard on "Control Chart Method of Controlling Quality during Production," for the use of manufacturers in India.

Seventh Pacific Science Congress

Some of the world's leaders in many branches of science gathered in New Zealand for the Seventh Pacific Science Congress.

About 120 scientists from over fifteen countries, including Britain, Canada and U.S.A. took part in the Congress which lasted until 23rd February, and which reviewed the whole field of science.

A transportation grant of \$ 20,000 was given by Unesco to the Congress, which made it possible for many scientists from countries bordering on the Pacific as well as from Norway, Holland and France to attend the meeting.

The last Pacific Science Congress took place in San Francisco, in 1939. The seventh meeting was originally due to meet in the Philippines in 1941 but was postponed on account of war.

Unesco Book Coupons in U.S.

The American Booksellers Association has been appointed to administer the Unesco Book Coupon programme in the United States, Mr. Milton S. Eisenhower, Chairman of the U.S. National Commission for Unesco, announced. This follows a recommendation by the Commission's Panel on Books.

The Book Panel's recommendation is the result of considerable study in order to integrate the Unesco Book Coupon Scheme into U. S. publishing operations.

The scheme was started by Unesco to overcome currency exchange difficulties and to enable educators, scientists, professional people and others in soft currency areas to purchase books and other publications in hard currency countries. Holders of these coupons pay for

their purchases in the money of their own country, and the coupons are redeemable by Unesco in the currency of the publisher's country.

The American Booksellers Association will transmit orders in the United States and arrange for redemption of the Unesco coupons.

CCRU Gives Institut Pasteur \$ 15,000

A gift of \$15,000 to the Pasteur Institute of France by the Canadian Council for Reconstruction through Unesco has been presented to Dr. Jacques Trefouel, Director of the Institute, by Dr. James A. Gibson, Chairman of the Executive Committee of the CCRU.

The money has been put at the disposal of the Institute to be used for the purchase of the scientific equipment.

In addition, the Institute has been offered for a period of three years, subscriptions to a number of learned and professional periodicals.

At a short ceremony at the Institute on 5th January, Dr. Gibson read a letter from Mr. Mackenzie King, until recently Prime Minister of Canada, saying this gift is designed to help the institution "to continue the scientific and humanitarian services which have earned for it the highest recognition throughout the world".

"The Council," Mr. Mackenzie King adds, "have requested me to convey to you this intimation of their desire to share in helping to alleviate some of the grievous difficulties arising from six years of war, and to help forward, in some small measure, the life-giving activities of the Pasteur Institute."

The CCRU is a national body which groups some sixty non-governmental organizations dealing with educational and social problems in Canada. It was created at the instigation of the Canadian Government and works closely with Unesco on problems of mutual interest.

Unesco Handbook of Opportunities for Study Abroad

Over 10,500 opportunities for international study in 166 subject fields in 27 countries are reported in a Handbook of Fellowships, Scholarships and Educational Exchange, called "Study Abroad," just issued by the United Nations Educational, Scientific and Cultural Organization.

The largest number of awards is available in the various branches of science, especially, medical sciences and public health, engineering, technology and chemistry. The second

most important subject is education, and the third social sciences.

In addition, the Handbook contains notes on the fellowship programme of the United Nations and the Specialized Agencies as well as summaries on the techniques of fellowship administration for those engaged in planning fellowship programmes. Fifteen per cent. of the reported opportunities are unrestricted both as to the nationality of eligible candidates and the subject field of study.

The aim of the publication is to increase the number and quality of candidates applying for fellowships, to suggest to prospective donors where new programmes may be developed, and to bring into perspective possible overlappings of emphasis and areas of outstanding need.

The reporting countries are Australia, Belgium, Burma, Canada, China, Colombia, Czechoslovakia, Ecuador, Eire, Finland, France, India, Italy, New Zealand, Norway, the Philippines, Portugal, South Africa, the United Kingdom and the United States of America. These have also supplied information on seven other countries.

The Handbook is published in English and French and will be distributed to Ministries of Education, National Commissions of Unesco, International Non-Governmental Organizations, Universities, Educational Periodicals and Libraries throughout the world. It is also on sale for individuals at Unesco House, Paris, and Unesco sales agents throughout the world at the price of \$ 1.00, 300 French francs or 5 shillings sterling plus postage.

Unesco Essay Competition

In order to stimulate public interest in its programme of work, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) has decided to conduct an essay and poster competition for young children in schools of member States.

The competition is entitled, "Together we build a New World". The entries should reach the Ministry of Education, Government of India by June 1, 1949, through the Provincial or State Government concerned from whom full particulars about the scheme can be obtained.

Sir Ben Lockspeiser

Sir Edward Appleton, K.B.E., K.C.B., will relinquish on the 30th of April, 1949, his appointment as Secretary to the Committee of the Privy Council for Scientific and Industrial Research.

The King has been graciously pleased to approve the appointment of Sir Ben Lockspeiser, M.A., M.I.Mech.E., F.R.A.S., to succeed Sir Edward Appleton.

Sir Ben Lockspeiser is at present Chief Scientist at the Ministry of Supply and will take up his new appointment on the 1st of May, 1949.

Grant to British Universities

In the coming Budget, Sir Stafford Cripps, Britain's Chancellor of the Exchequer, is providing £ 12,814,500 (Rs. 17.09 crores) for recurrent grants to universities. He announced this in reply to a question in the House of Commons. This amount includes provision for the additional expenditure which universities will incur in bringing into operation the revised scales of payment of teachers in the medical and dental schools.

The progress of the universities' scheme for physical education necessitates an increase in the amount required for non-recurrent grants and Sir Stafford is providing £ 4,750,000 (Rs. 6.33 crores) for this purpose, as against £ 2,600,000 (Rs. 3.47 crores) for the current year.

Entomological Society of India

The Eleventh Annual General Meeting of the Entomological Society of India was held on 4th January 1949, in the Zoological Lecture Theatre of the University of Allahabad. The President Dr. H. S. Pruthi delivered the Presidential Address on "Need of Fundamental Research on Insects in India".

The following resolutions were passed:

1. In view of the need for greater contacts and collaboration among entomological workers in different parts of India and between India and other countries of the world, the Entomological Society of India should periodically prepare a list of such workers engaged in Agricultural and other Applied Departments as also in various Universities, in India. Such a list should indicate the special interests of the individual workers and be published or otherwise printed for the information and use of all concerned.

2. In view of the great importance of fundamental research on insects, not only for solving various urgent problems in relation to crop, specially food production, the cottage industries of bee-keeping, silkworm rearing and lac culture, public health, forest management and conservation and life-stock improvement, but also for the better elucidation of

various scientific problems, such as those of animal (including human) behaviour, heredity and population, the evolution of forms, habits and communities, the laws of growth and migrations, etc., the Entomological Society of India feels that the establishment of a National Entomological Laboratory for fundamental researches is an urgent, national, scientific need. Such a Laboratory incidentally will provide the centre where research workers will occasionally gather from all parts of India for information, guidance and training and also for inspiration and thereby improve the standard of entomological research all over the country. The Society, therefore, recommends to the Government of India to establish a National Entomological Laboratory for India and draws the attention in this connection to the recent statement of the Prime Minister of India at the Indian Science Congress session at Allahabad, to the effect that India should undertake and do much more fundamental or basic work in science than has been the case so far.

In view of the great and undeniable importance of Entomological Research, both, to the developing economy of India as well as to Science in general, and in view of the acute shortage of trained Entomologists in the country specially needed for various nation-building activities, the Entomological Society of India recommends to the Indian Universities Commission to take steps to extend, improve and intensify Entomological training and research in the universities of India. In this connection the Society, if invited, would gladly assist the Commission by providing concrete plans and suggestions as to how the desired development of Entomological Research and training may be brought about.

The following Office-bearers were elected for 1949-50:—

1. President — Dr. H. S. Pruthi (New Delhi).
2. Vice-Presidents — Dr. E. S. Narasayanan (New Delhi), Dr. D. R. Mehta (Kasauli), Dr. N. C. Chatterjee (Dehra Dun), Mr. M. C. Cherian (Coimbatore).

3. Councillors — Dr. D. D. Mukerji (Calcutta), Mr. Ramechandran (Coimbatore).

4. General Secretary — Dr. S. Pradhan (New Delhi).

National Institute of Sciences of India

At the Annual General Meeting of the National Institute of Sciences of India, held at Allahabad, on the 4th January 1949, the following were elected Office-bearers and Members of its Council for the year 1949:—

President: Prof. S. N. Bose (Calcutta). Vice-Presidents: Prof. A. C. Banerji (Allahabad), Maj.-Gen. Sir S. S. Sokhey (Bombay); Treasurer: Dr. C. G. Pandit (Delhi). Foreign Secretary: Dr. J. N. Mukherjee (Delhi); Secretaries: Prof. D. S. Kothari (Delhi); Dr. H. S. Pruthi (Delhi). Editor of Publications: Dr. S. L. Hora (Calcutta). Members of Council: Dr. K. N. Bagchi (Calcutta), Dr. S. K. Banerji (Delhi); Mr. S. Basu (Poona); Prof. H. J. Bhabha (Bombay); Prof. S. R. Bose (Calcutta); Dr. B. B. Dey (Madras); Prof. A. C. Joshi (Hoshiarpur); Dr. S. Krishna (Dehra Dun); Sir K. S. Krishnan (Delhi); Prof. S. K. Mitra (Calcutta); Dr. B. Mukerji (Calcutta); Mr. G. R. Paranjpe (Poona); Dr. M. Prasad (Bombay); Mr. J. M. Sen (Calcutta); Dr. A. C. Ukil (Calcutta).

The following distinguished Foreign Scientists were elected Honorary Fellows of the Institute:—

1. Prof. Louis de Broglie, Professor of Theoretical Physics, Poincare Institute, Sorbonne, Paris. 2. Prof. Hans von Euler, Emeritus Professor of Chemistry, Stockholm University, Stockholm. 3. Dr. Harlow Shapley, Director of Harvard Observatory and President of the American Science Association. 4. Prof. Georg Tischler, Botanical Institute, Kiel University, Germany.

The following have been elected Ordinary Fellows of the Institute:—

1. Dr. Jnanendralal Bhaduri, Lecturer in Zoology, Calcutta University. 2. Dr. S. Bhagavantam, Scientific Liaison Officer for India in the United Kingdom. 3. Dr. S. K. Chakrabarty, Director, Colaba and Alibag Observatories, Bombay. 4. Dr. D. Chakravarti, Lecturer in Chemistry, Calcutta University. 5. Dr. M. Damodaran, Assistant Director, National Chemical Laboratories, Delhi. 6. Dr. B. K. Das, Professor and Head of the Department of Zoology, Osmania University, Hyderabad-Deccan. 7. Dr. Kurien Jacob, Palaeobotanist, Geological Survey of India, Calcutta. 8. Dr. T. S. Mahabale, Lecturer in Botany, Royal Institute of Science, Bombay. 9. Dr. H. K. Mitra, Refractories Engineer, Tata Iron and Steel Co., Ltd., Jamshedpur. 10. Dr. Kalidas Mitra, Officer-in-charge, Nutrition Scheme, Public Health Laboratories, Bihar, Patna. 11. Dr. A. H. Pandya, Director, Hindusthan Aircraft, Bangalore. 12. Dr. N. Parthasarathy, Geneticist, Indian Agricultural Research Institute, New Delhi. 13. Dr. C. Racine, Professor and Head of the Department of Mathematics, Loyola College, Madras. 14. Dr. K. C. Sen, Director, Indian Dairy Research Institute, Bangalore. 15. Dr. R. S.

Varma, Reader in Mathematics, Lucknow University, Lucknow.

Awards of the following Research Fellowships were made:—

Imperial Chemical Industries (India) Research Fellowship:

Dr. S. N. Ghosh (Physics), Calcutta University, Calcutta. Dr. L. R. Row (Chemistry), Andhra University, Waltair.

National Institute of Sciences Senior Research Fellowship:

Dr. A. P. Kapur (Zoology), Zoological Survey of India, Calcutta.

Reports on Scientific Advances during World War II

Dr. Alexander Wolsky, the Principal Scientific Officer of UNESCO, New Delhi, has advised us that the Pontifical Academy of Science (Vatican, Rome, Italy) has undertaken to compile a general report of the scientific research work accomplished throughout the world during the critical years of the second world war, when scientific communications were greatly disrupted. "The initiative is in conformity with the august wish of the Holy Father to see international scientific communication restored promptly and on a large scale, thus contributing to ease the strained relations existing between peoples, as well as to enrich the fund of human knowledge by new and useful elements". It is proposed that the general report will be divided into a series of particular reports referring to one or more countries and will treat the various branches of science on the basis of the papers published in the well-known scientific journals or reviews, as will be selected by the respective authors of the reports. Dr. Wolsky has recently received 18 such reports the titles of which are listed below and the language is also mentioned in brackets:—

1. La Physique Du Noyau: Dans Certains Pays D'Europe Durant La Periode 1939-45 (French). By C. Manneback.

2. Progres Recents: De La Theorie Quantique Des Champs Et Du Meson (French). By C. Manneback.

3. The Liquid State: Position of the Problem in the various countries since 1936 until 1945. (English) By Andrew Van Hook.

4. Development of Mathematical Biophysics in U.S.A. from 1939 to 1945 inclusive (English). By N. Rashevsky.

5. Spektrochemie: Die Wichtigsten Spektrochemischen Veröffentlichungen in Deutschland: Aus Den Jahren 1939, 1940, 1941, und 1942. (German). By A. Gatterer.

6. La Meccanica Razionale: E La Fisica Mathematica Nell' Italia Centrale E Meridio-

nale Dal 1939 A Oggi (April 1946) (Spanish). By Antonio Signorini.

7. La Meccanica Razionale E La Fisica Mathematica Nell' Italia Settentrionale E in Svizzera Dal 1939 al 1945 (Spanish). By C. Somigliana, B. Finzi, C. Cattaneo.

8. La Geometria Differenziale in Italia (Dal 1939 al 1945) (Italian). By Piotra Ruzano.

9. Geometria Algebrica: Nei Paesi Anglosassoni (Dal 1939 al 1945) (Italian). By Beniamino Segre.

10. Analisi Matematica in Italia: Nel Campo Complesso (Dal 1939 al 1945) (Italian). By Aldo Ghizzetti.

11. La Geometria Algebrica in Italia (Dal 1939 a tutto il 1945) (Italian). By Fabio Conforto e Guido Zappa.

12. Ottica Fisiologica: E Problemi Della Visione Nel Vari Paesi Dal 1939 al 1945 (Spanish). By Francesco Schupper.

13. Lavori Geodetici Italiani: Dal 1° Gennaio 1939 Al 31 Dicembre 1945 (Italian). By Giovanni Boaga.

14. Accion De La Tiroides Sobre El: Metabolismo de los Hidratos De Carbono Y En La Diabetes (Resumen de los Trabajos De 1939 A 1945) (Spanish). By Bornardo Houssay.

15. Progress in the Knowledge of Gram-negative Enteric Pathogenic Organisms during the years from 1939 to 1945 (English). By Oscar Felsenfeld Viola Mae Young Phyllis Conner.

16. La Produzione Cancerologica Sperimentale in Italia e in Germania Lal 1940 al 1945 (Italian). By Pietro Rondoni.

17. L'Aerodinamica in Italia (Dal 1939 al 1945) (Italian). By Enrico Pistolesi Carlo Ferrari.

18. I Motori Aeronautici in Italia (Dal 1939 al 1945) (Italian). By Antonio Capetti.

The periods covering the reports are also mentioned along with the titles. The bibliographies appended with each of these publications appear to be useful to the scientific workers in the respective fields.

These publications are being brought to the notice of our readers in the hope that these might offer an idea of the work carried out particularly in the countries of Europe, which were cut off from contacts with other countries in the course of the last world war.

Only one copy each of the reports is available at the Office of the UNESCO at Delhi for personal inspection, by those interested but in case of requests from long distances it might be possible to send them for perusal and speedy return.

ERRATUM

Note entitled "Varagu" (Pasupalum Scrobiculatum)

Curr. Sci., 1948, 17, p. 367, column 2, line 4—
'Saponification value' read 170.7 for 107.7.

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